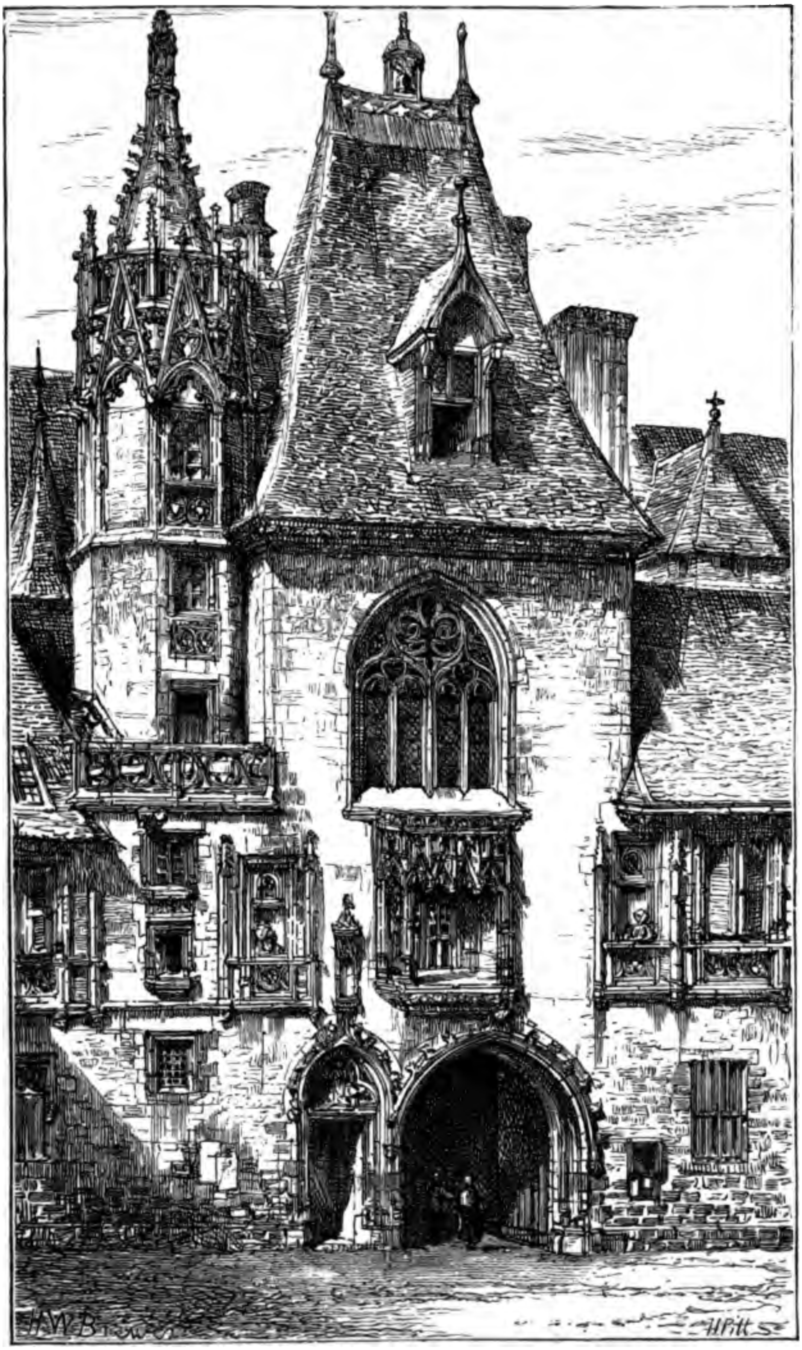
HOUSE ARCHITECTURE

J. J. STEVENSON



JACQUES CŒUR'S HOUSE AT BOURGES.

HOUSE ARCHITECTURE.

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BY

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CHAPTER I.

HISTORY OF HOUSE-PLANNING.

IN building a house, one of the first things to be considered is the plan: and it is perhaps the most important, for on proper planning and arrangement depend the use and comfort of the house while it lasts. House planning is an art in which amateurs are peculiarly liable to go wrong. They may have correct notions on some points, but in carrying them out they are apt to lose sight of others among the complicated requirements of modern house planning equally or more essential.

A large amount of human ingenuity has been devoted to the subject from the first dawn of the race; as new wants grew, new expedients being invented to satisfy them. The present practice is the result of improvements (or change at least) carried on through centuries, of gradual development—fitting themselves to the habits and customs of each period, and consequently a true indication of them. A history of house-planning is therefore a history of civili-

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sation, one of the best means by which we can realise the social condition and family life of successive times.

The fashions of architectural style have also to some extent influenced the plan of English houses. At one time the Classic principle of symmetry was absolute; in some instances, in late years, arrangements peculiar to the Middle Ages have been adopted. But custom and convenience have been too strong for such influences permanently to affect the general practice, so that a progression can be traced in planning, indicative of the manners of the time. The builder of a house may have his own likings as to style and ornament, or may adopt those of his architect; but whether Classic or Gothic, the plan must have all modern conveniences, and must suit our habits and customs, not those of our ancestors.

There is in the present day a definite standard of requirements as to plan, just as there is a certain state of advancement in ship-building or making steam-engines, which may be more or less perfectly realised according to the skill of the architect or engineer. It will help us in understanding the principles of modern house-planning, and the difficulties which have been overcome in arriving at our present results, if we trace briefly the stages in the slow process of development.

The earliest house in this country seems to have been a hole in the ground, roofed with wattles or covered in with earth; the entrance a tunnel, small and tortuous, so as to make the intrusion of wild beasts and enemies difficult. In some more refined examples provision is made for drainage, so that the inmates should not lie in perpetual mud. They may have had fires, but there was no provision for the smoke escaping unless through the roof; probably warmth was obtained chiefly by avoiding all waste of the animal heat. Some remains of ancient British settlements exist in the country. One of these near the North Tyne

consists of a number of circular stone-built huts, placed together irregularly on a small elevated plateau once fortified by a palisade or wall, each a little over twelve feet diameter inside, so that the inmates would have room to sleep with their heads to the wall, and their feet at a fire in the centre. The same condition of life still exists in Irish cabins and the slums of great cities. It would be error to conclude that, to those accustomed to it, it is continued misery. Fresh air and cleanliness are the luxuries of the well fed and well clothed; for people half naked and half starved they are an uncomfortable waste of heat, which is life; and we find that the most stringent police regulations are needed to enforce them. Even to men used to the comforts of life, such dwellings are not intolerable. The huts, woven of tree branches, which the German army made for themselves in their encampments round Metz, bore a strong resemblance to the houses of savages. Those in the French camps, formed of mud, looked even more aboriginal.

To uneducated people, life perpetually in common, without any opportunity for retirement, is not irksome. Solitude, rather, is painful to them. It has charms only for those with internal mental resources. And even the educated and refined can for a time enjoy life in a yacht, where the same small cabin serves for living, eating, and sleeping in.

But this is exceptional. Privacy is essential to our comfort; and to live in its fulness and variety our modern life, we require apartments appropriated to its various phases.

The history of house-planning is consequently merely an account of the ever-growing subdivision of apartments to suit the new wants of comfort and civilisation; which is now carried to such an extent that in a great house there may be more than forty different *kinds* of apartments, almost

making life a burden, so that it is a relief to the owners to escape from it to Continental lodgings.

During all the long ages through which the human race has passed one prominent feature of house planning has been the necessity of defence from attack by enemies. We cannot even now leave it out of account, though the doctrines of peace and goodwill among men have been proclaimed and formally accepted for so many centuries; our line of defence is only moved farther off from our houses, to our "streak of silver sea," with its iron-clads. But during all the Middle Ages this risk was at the door: houses had to be fortified, and this influenced their plans and arrangements.

But in the rudest stages of house planning, as well as in the latest, the houses themselves were not fortified. To do this, requires more skill and civilisation than the times possessed. The Romans had left throughout England numerous permanent camps—great square enclosures of many acres in extent, surrounded with massive walls, built with such excellent mortar that they have defied the constant efforts of all the time since to get the stones of them for new buildings. These the Saxons appropriated, keeping the old name of Castrum or Chester. No doubt they used the Roman buildings inside them, if they survived the siege, when they served their purpose. But, in time, from want of skill in masonry to repair them, they must have become ruinous, when they would be replaced by the huts of wood or mud which the Saxons were accustomed to build for themselves. The city of Winchester consisted of rows of low huts or hovels of wood or mud, each of one room, covered with thatch, closely packed together, and their inhabitants closely packed in them.

Among all the nations of Northern race, the dwelling of the chief was a single great hall, built of wood, with a separate apartment for the women. With the Norsemen, as

we know from their Sagas, it was a great nave, like a church, lighted by a clerestory, the aisles divided into sleeping boxes, like the box beds, still common in that country, and till lately in Scotland; the women's apartment, a separate building at the inner end. It was roofed at times, no doubt, as the houses in Norway still are, with turf; but the projecting beams were richly carved and brightly painted.

This practice of building in wood, all these Northern nations continued in the countries they conquered, at least in their more important buildings. In the Icelandic Sagas, wood being scarce there, we constantly read of the richer men sending to Norway for trees to build a hall. M. Viollet-le-Duc attributes the wooden-built houses of England and Normandy, during the Middle Ages, to the continuance of this tradition.

In England the Saxon Thegne built his hall from the woods of his demesne by the labour of his bondmen. The roof was thatched with reeds and straw, or covered with wooden shingles, supported by wooden posts. The king's villains were compelled by law to erect nine buildings for him; a hall, a chamber, a buttery, a stable, a dog-house, a barn, a kiln—or oven, I suppose—a privy, and a dormitory.[1] No kitchen was needed, for the cooking was done at the same fire as warmed the inhabitants, or for great repasts or in summer, in the open air, all the more that there was risk of fire in the wooden buildings. Camping out was the normal existence, the hall being only a more permanent camp.

These buildings were all of one story, and were sometimes

[1] 'Some Account of Domestic Architecture in England in the Middle Ages.' 8 vols., 1851-9. Vol. i., Introduction. To this excellent work, begun by Mr. Hudson Turner, and continued with admirable research by Mr. Parker of Oxford, I am indebted for much of the information in this chapter. It contains documents and dates, and numerous illustrations, from which a full and true idea may be formed of life and civilisation in England in those times.

connected by covered ways; they were surrounded by a wall, over which Saxon pictures of such dwellings in their manuscripts show the roofs just appearing.

The Saxon lord and his "hearthmen," analogous to the "Counts" or "Comites" of the Frank sovereigns, sat by the same fire at which their repast was cooked, and at night retired with him to the same dormitory, which served also as a council chamber. The manners were rough and rude. It is told in praise of one king, that "he acted acccording to justice, nor drunken struck his hearth companions."[1]

The dwellings of the Frankish conquerors of Gaul were similar in their arrangements. They appropriated the villas or country houses, numbers of which the Roman occupation had left in the country, consisting each of a collection of buildings connected mostly by covered passages, for housing the lord and his family and retainers, for the villains who cultivated the farm, and the farm offices; all surrounded by a wall. In this country, as in France, roads were bad and impracticable for wheeled vehicles; carriage of goods was possible only by sumpter animals, so the sovereigns, instead of having their provisions brought to them at one fixed capital, went in turn with their court to their different manors, staying in each till the provisions collected were consumed; and then moved on to another, followed by an enormous train of sumpter animals, carrying the hangings and furniture of one house to another, and even, this till much later times, the glazed frames of the windows.

The dwellings of the poor then, and for centuries after, were huts of the simplest description. When the Normans effected a landing, and conquered at Hastings, no fortified places obstructed their march to London. The Saxons had to make their farther defence in the woods and marshes. But the Conqueror at once built castles throughout the country to hold it, which make a stage in English domestic

[1] Parker, Introduction, p. ix.

architecture. The main feature of the Norman castle is the great Keep, standing in the court, formed by the strong enclosing walls of the castle bailey. It was the last stronghold if the outer defences were taken, and was a dark and rather dismal dwelling, for the conveniences of living were subordinated to the necessities of defence; near the ground the only openings were arrow slits, and even in the dwelling rooms, on the upper floors, the windows were narrow and barred.

It sometimes contained a large garrison. One wonders where the hundreds of men we read of were stowed away; but, after all, they might not be closer packed than in a man-of-war or an emigrant ship.

The castle garth contained other buildings besides the keep; lean-to sheds against the enclosing walls for stables and offices, and for housing the men-at-arms. Sometimes also there was a hall. In the castle garth at Newcastle-on-Tyne, there was a large hall built of wood and plaster, with a circular window in each gable.

Built for defence, these Norman castles were not always well planned for daily life. In Rochester Castle, the chapel entered through the king's chamber, till Henry III., to get some privacy, ordered an outside stair to be made to the chapel.

The planning even of the Royal residences was imperfect. At Clarendon, the access from the king's chamber to his chapel was by a trap ladder, for which a spiral staircase was substituted by the same king.

During the thirteenth century, as we find from surveys in the reigns of Henry III. and Edward I., the great towers or keeps had become ruinous and generally roofless. As the Norman rule became established they had become useless for war, and had been abandoned for habitation; though, if need were, they were still capable of defence.[1]

[1] Parker, vol. i. p. 3.

Alexander Necham or Nequam, schoolmaster of St. Albans, in the end of the twelfth century, and afterwards Abbot of Cirencester, gives us in his treatise, 'de Nominibus Utensilium,' some light as to the ideas of the period on house arrangement. In describing the various parts of a house, he enumerates the hall, the private or bed chamber, the kitchen, the larder, the sewery and the cellar;[1] and (except that they had also chapel) the king's houses at Clarendon, Kensington, Woodstock, Portsmouth, and Southampton appear, judging from the exchequer accounts of the time of Henry II., to have had these chambers and no more. The Royal houses differed from others, only in these chambers being larger.

The chief feature of every house during the Middle Ages was the HALL. It was in reality the house; and hence country houses are still called halls. The name is Saxon, possibly from the same root as the Latin "aula." With the introduction of French speech it was called "la sale" or "salle" another form of the same word. The usual plan was the same as we still find in the halls of colleges and inns of court. The door at the side at one end opening into the "screens," a passage or vestibule screened off from the hall by a wooden partition, in which were two doors placed at the end of the passages between long tables of the hall; on the other side of the "screen," were two doors entering into the kitchen and buttery. The screens sometimes formed a passage to the inner court, as at Haddon (fig. 138, p. 24), and Trinity College, Cambridge, and from it a stair sometimes ascended to a gallery for musicians, over them, or to the upper rooms of the house.

At the inner end of the hall was the "DAIS," a platform one step high, across the hall, on which was placed the high table, and behind it was usually the entrance to the private apartments.

[1] Parker, vol. i. p. 58.

According to Necham, the windows of the hall should be to the east, I imagine, in order that it might have the morning sun, for the household in those days rose early, while during the remainder of the day it would keep cool. Necham suggests that curtains may be hung from the tops of the columns for the purpose of dividing the hall, for one of its uses was for sleeping in. Curtains were also used, as we see in old manuscript illustrations, instead of doors for openings.

In the front court the kitchen was placed and probably the stables, and Necham also speaks of an inner court for cocks and hens and geese. The life of even great lords was simple and homely. The whole was surrounded by stone walls or a fence of wood and a moat.[1]

The hall had not always a fireplace, though, as fireplaces and their chimneys were sometimes constructed of plaster, against the wall, they might become ruinous and disappear without leaving any trace. The fire was frequently in the centre of the hall, on a hearth of brick or stone, the logs being raised on andirons. Louvres were made in the roof to let the smoke out. The hall was thus heated more equally, and a greater number could get round the fire. People do not seem to have minded the smoke, which is less unpleasant from a wood fire than from coal. This custom continued in many college halls, in Oxford and Cambridge, till about 1820; the fireplace in the centre of the hall of Westminster College was done away with in 1850.[2]

In the hall was transacted the whole life of the household. Its primary purpose was for the meals; when these were over, the boards were removed—the tables were merely boards placed on trestles—and the space cleared for dancing, or games, or exhibitions of masques and buffoonery. When night came, the household slept on shake-down beds

[1] Parker, vol. i. p. 6. [2] Ibid., vol. ii. p. 39.

on the floor; a custom which gave frequent occasion for scandal, as we know from the tales and poems of the time.

Another important use of the hall was as a court of justice, for on his own domains the lord tried causes and had even the right of passing sentence of death.

The hall was frequently of a great size. That at Oakham Castle is sixty-six feet by forty-three, divided into a nave and aisles, by pillars with round Norman arches. Sometimes there was one row of pillars and arches down the centre. More frequently the roof had wooden posts to support it; generally when of more moderate size, they were clear and undivided.

After the hall, the most important apartment was the SOLAR. The derivation of the name is uncertain. The Solar was usually a large apartment, placed at the inner end across the hall, on a higher level, sometimes over the cellar. It was the chamber or private apartment of the family, the ladies' "bower," devoted during the day to the use of the ladies. It was used also as a sleeping-room, and sometimes, as bedrooms frequently were, as a council-chamber, and even as a private dining-room. In connection with the Solar there was usually a garde-robe.

In early times the houses even of the king differed from others only in having the hall and chamber larger. In some cases, especially in later times, the house had in addition some smaller rooms, where the lord or chief persons could be private. As in a ship, the captain and chief officers have their private cabins; the sailors are together in the forecastle, where their hammocks are slung at night and stowed away during the day, to leave the space free for meals.

During the first century and a half of the Norman

[1] Parker, vol. i. p. 6.

occupation of England, few dwelling-houses were built, except the castles, for holding the country, abbeys, and other religious houses.

Land had not yet been much subdivided; whole districts of great extent were held by the heirs of the Conqueror's followers, who ruled almost like independent princes in their feudal strongholds.

During the long reign of Henry III. (1216–1272) numerous licences were granted for crenellating or fortifying manor-houses, indicating that the mesne tenants of the great barons were beginning to build substantially on their own account, and the process was continued during the succeeding reign of Edward I.

One feature common to the planning of almost all these houses, is that they have only one apartment in their width, so that all the rooms might have been lighted from both sides. The hall is the house, additional rooms being added at either or both ends.

Stokesay Castle, in Shropshire, seven miles north of Ludlow, on the road to Shrewsbury, remains a perfect example of a fortified manor-house of the time of Edward I. The architecture is very beautiful: the hall and solar are lighted by two-light traceried windows, the upper parts of which have been glazed, while the lower, under the transoms had wooden shutters. Being used as farm offices, it has not been altered to fit it to modern habits, and has happily been spared the process of restoration, which would have destroyed its value as a record, by substituting a modern architect's notion of what it might once have been, for the reality.

The licence to crenellate was granted in 1291, about which time it was probably built; though Mr. Parker, judging from the style of the architecture, thinks the hall may be a few years earlier, the tower at the south end only being built in 1291.

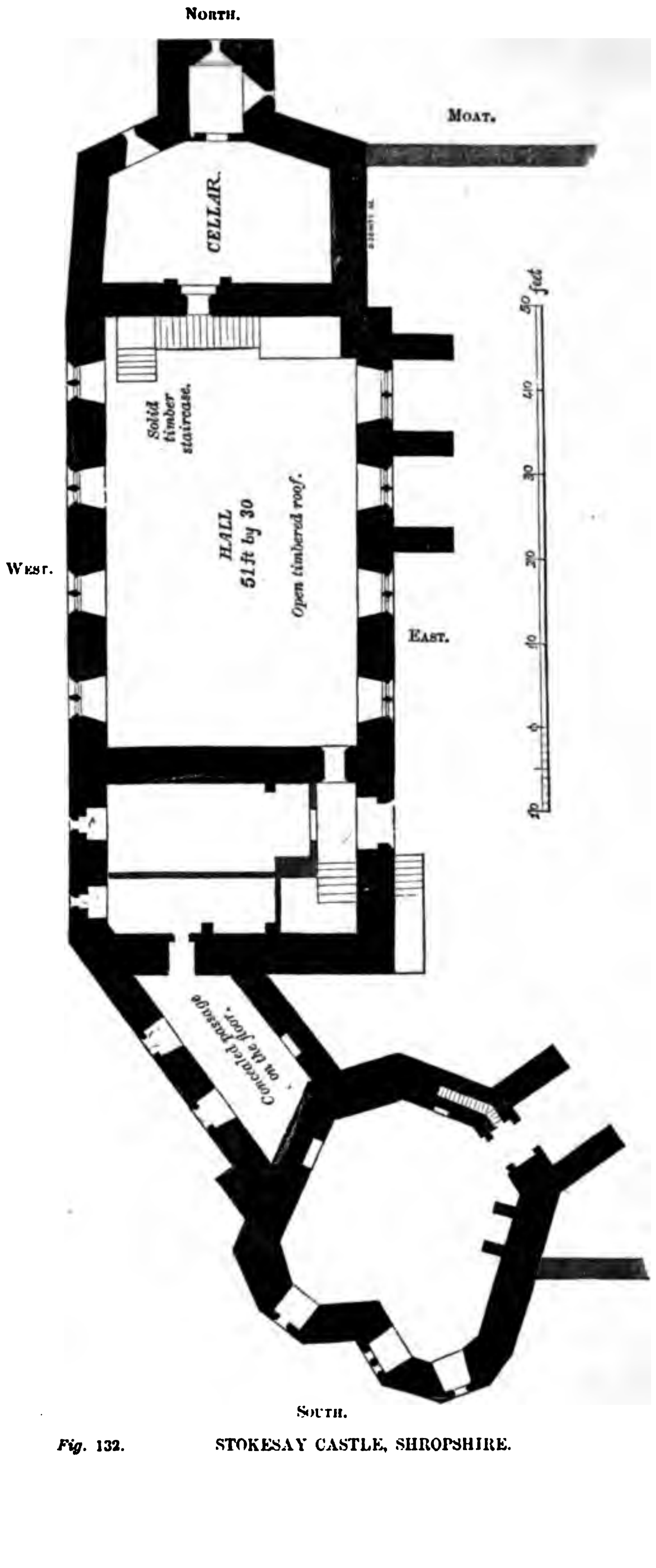


Fig. 132. STOKESAY CASTLE, SHROPSHIRE.

It stands (fig. 132)[1] at the west side of a court, enclosed by stone walls, all surrounded by a moat, twenty-two feet wide, to fit which the buildings have been erected in a curved form. The hall is of one story, with a fine open timber roof. Its door is in the northernmost bay on the east side, under a window. At the inner or south end is a small door, leading by passages to the tower, three stories high, which was occupied by private apartments or bedrooms, by a second door into the court, and by an outside stair to the Solar, which occupies the space over these small rooms and passages. This stair had once a roof over it, as is shown by the weathering on the wall. The Solar had two small windows looking into the hall. This is a frequent arrangement, so that the lord from his private apartment might keep an eye on what was going on in the hall.

The tower has its own door to the court, from which a stair in the thickness of the wall ascends to the rooms in its upper floors. This door, as well as that of the hall, is flanked by great buttresses, which would limit the number who could attack it, and prevent an assault except in front. The tower could hold out even if the hall were taken. Its separate door would give it the necessary isolation.

At the north end of the hall is a cellar and a small tower opening out of it, built in the moat, and provided with loopholes, with the object apparently of defending the hall at this corner, and flanking the moat on the north side of the court. Over this cellar and tower are now rooms built in wood and plaster.

The kitchen was probably in the court, along with other out-buildings.

[1] I am indebted to the kindness of Mr. Parker of Oxford, for the use of the plan of this house, as well as of the others which follow, from his father's book on 'English Domestic Architecture in the Middle Ages.'

[2] Parker, vol. i., Introduction.

Stokesay Castle is a good illustration of the ordinary type of the fortified English manor-house, in which the hall was a separate building with no rooms over it, the Solar or other rooms being at either end.

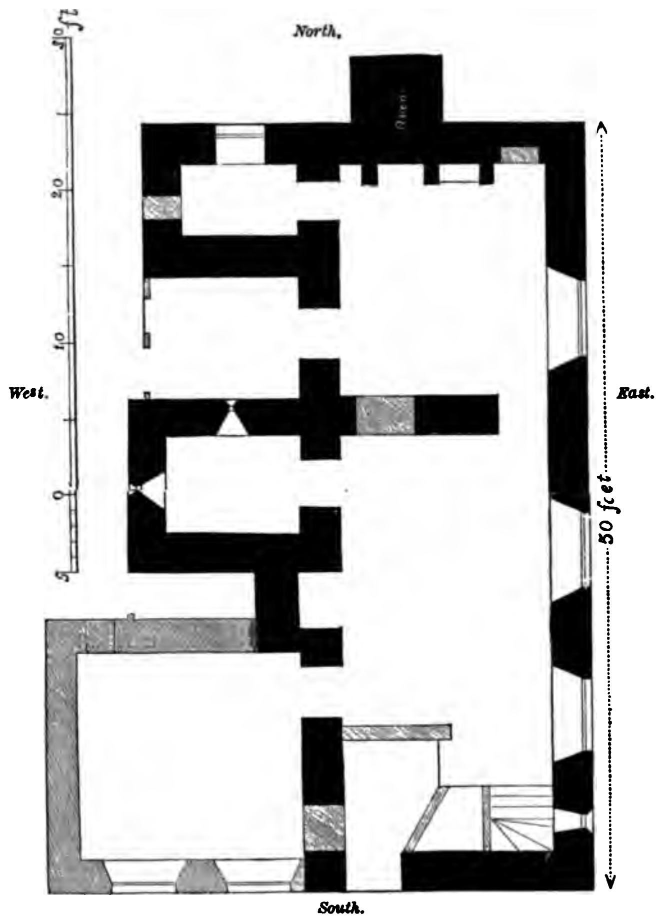


Fig. 133. COTTESFORD MANOR-HOUSE, OXFORDSHIRE.

Cottesford Manor-house, in Oxfordshire,[1] six miles north of Bicester (plan, fig. 133), is of a quite different type, being a small simple gabled house of two stories and attics, with

[1] Parker, vol. i. p. 161.

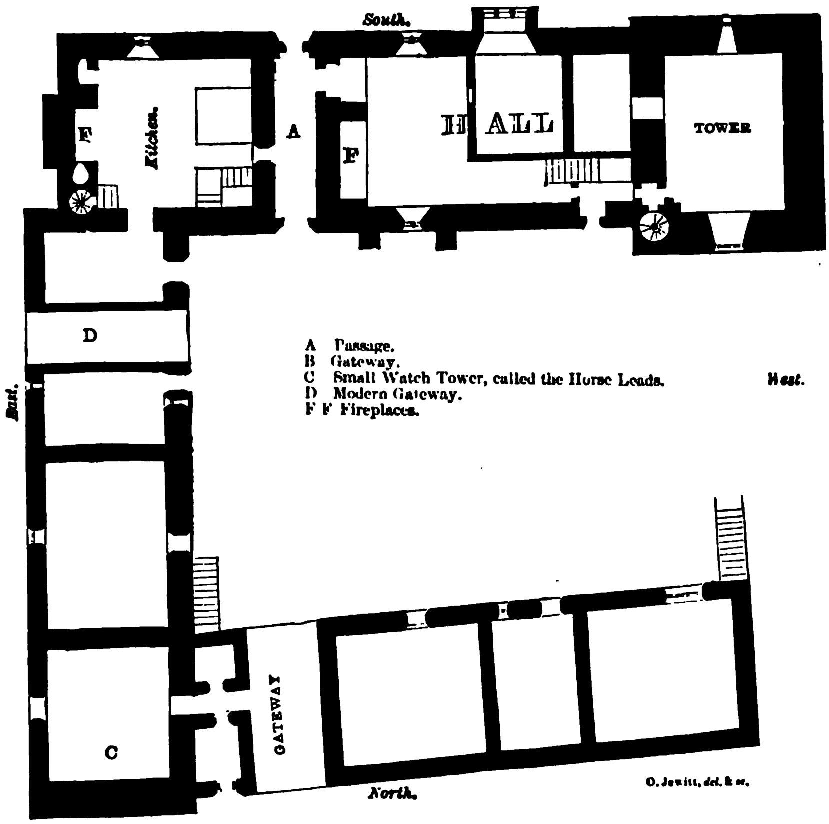
two projections at the back. An attic window in the north gable, with centre column supporting two round arches of Norman or transitional character indicates the date of the house, as about the end of the twelfth or the beginning of the thirteenth century. The front faces east, as at Stokesay, and as Necham advises. The ground floor consists of a hall with a hooded fireplace, the cellar opening out of it, and of a kitchen beyond with fireplace and oven. The house had new windows, and was otherwise altered about the sixteenth century. The parlour (shaded lighter in the plan) at the south-west corner is modern. The hall door was probably the blocked up opening, shaded lighter at the south end of the west wall, leading into the "screens," and the stair to the upper stories. This arrangement would bring the fireplace to the centre of the hall, making the size of the hall about twenty-three feet by fourteen. The arrangements of the first floor are quite modern; not improbably it was one large room, having the stair to the attic bedroom, which is in the little projection to the west of the kitchen, at its inner end.

About a century later, we find a record of a house exactly similar in form, and about the same size. In the year 1314, Sir John Bishopsden of Lapworth, in the county of Warwick, contracted with two masons to build him a convenient house[1] of freestone, at his manor at Lapworth. It was to be forty feet long within the walls, and eighteen wide; the gables three feet thick; the back and front walls two feet six. On one side of the door there was to be a base chamber with fireplace and wardrobe, and fitting doors and windows; on the other, a chamber without fireplace, but with fitting doors and windows. This story was to be eleven feet high.

Over it was to be a sovereign chamber, with two fireplaces, forty feet long, and eighteen wide, with two

[1] See the contract in the original old Norman French in Parker, vol. ii. p. 5.

wardrobes projecting out of it; the ceiling, nine feet high, from floor to rafters. Mr. Parker remarks that in this sovereign chamber, the ancient arrangement of the hall is still preserved, but this room was rather the Solar, placed as was usual in town houses. The door was to have a draw-



Plan of ground-floor.

Fig. 134. YANWATH HALL, WESTMORELAND.

bridge, showing that the house was closely surrounded by a moat.

Yanwath Hall, Westmoreland (figs. 134 and 135), in its oldest parts, dates from the first half of the fourteenth century,

but it had new windows and various alterations in the reign of Henry VIII. It stands two or three miles south of Penrith, beside the Lancashire and Carlisle Railway, on a steep wooded bank above the river Eamont.

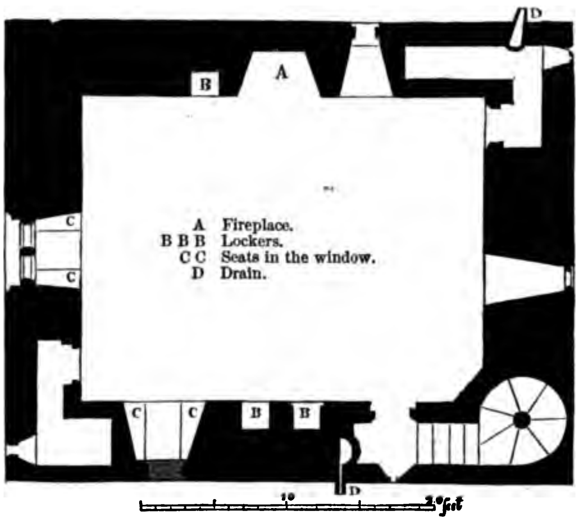
In its arrangements it follows the traditional type of English country houses. The buildings occupy three sides of a court, the wall or buildings which must formerly have enclosed this court on the west side being destroyed. The hall-entrance is from the court by the larger door seen in the view (fig. 136) through the passage A in the plan, which goes through the building. This opening to the south is probably of the later date, as is the oriel in the hall. These would have been joints in the armour of a fortified building. The kitchen is on the other side of this passage, according to the usual arrangement; the private apartments are at the inner end of the hall in the tower. The position of the hall fireplace is unusual, just behind the door. The arrangements remind one of the plan of a college, with the rooms ranged round a quad, which is but a survival from the houses of the period. In this case, the rooms in the north and east sides, which are now farm offices, may have been used as living rooms.

The tower at Yanwath Hall dates from early in the fourteenth century, with the exception of the Tudor windows on the ground and middle story, seen in the view (fig. 136). It is not improbable that this tower may have been at first the whole house. Taken alone it is a good specimen of a class of fortified houses, the Peel Towers, common on the borders while border raids continued till the district became the peaceful centre of the kingdom, instead of the boundary of two hostile nations.

It retains its old character in the upper story, in which the small windows still remain. They are as large as the inhabitants dared make them for safety, though they are high above the ground. In the peel towers this upper room

was the family living room, as it was more secure, and could have larger windows than the lower stories. From the plan (fig. 135), we see that it was fitted with conveniences for the daily life of a family, a fireplace at A; lockers or cupboards B B, seats in the windows at C C; a scullery with its drain at D, and in the other corner a closet or garde-robe.

The story below this in the peel tower was occupied by the retainers and defenders. In the Scotch examples the



Plan of the upper story of the Tower.

Fig. 135. YANWATH HALL, WESTMORELAND.

ground-floor is generally a vault into which the cattle were driven when a hostile raid occurred, without any communication with the floors above, which were approached by an outside stair, sometimes only by a ladder which was pulled inside. In this case the stair to all the stories and the roof is in the corner, an arrangement which we find also in the Scotch examples. The Scotch towers were constructed on the principle that burning them would not spoil them. Sometimes they were of stone throughout, the floors vaulted,

the stone slabs of the roof carried on a steeper vault. More usually the floors, except the first above the ground, were of

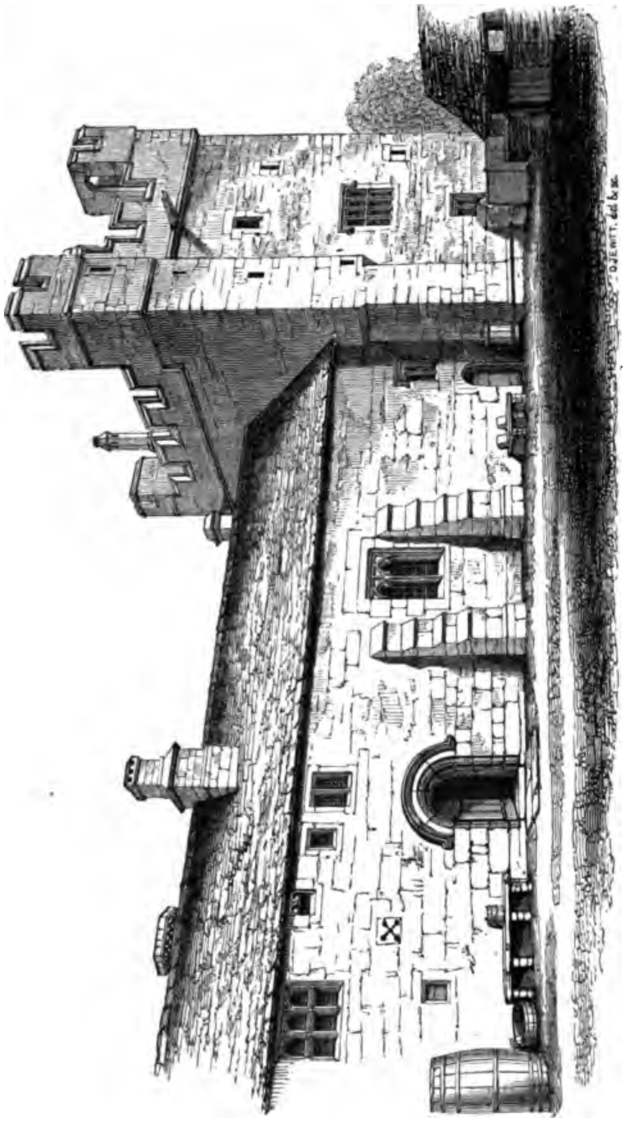


Fig. 136. YANWATH HALL, WESTMORELAND.
From the Court-Yard.

wood supported on corbels, free from the walls, so that if burnt they were easily replaced and the walls got no harm.

Similar towers are numerous in Ireland, of all dates, from the twelfth century to the seventeenth.[1] From the fighting character of the people, every house had to be fortified, even the abbeys. The Irish towers are plain and rude, the windows in the lower part mere loopholes, the state apartment at top, fitted with some attention to ornament and comfort. These towers continued the usual dwelling-houses of the gentry, whether English or Irish, till Cromwell showed them that such ancient defences were of no use against gunpowder.

In the reign of Edward I. (1272–1307) numerous great castles were built with the same object as the earlier Norman castles, to hold in security newly conquered territory. They differed considerably from these in their character and arrangements. Instead of gloomy keeps or donjons, standing in a court surrounded by great walls, the hall and other apartments of a nobleman's dwelling were grouped together in one house. They partook in the general advance of refinement. While still fortified they were pleasant houses to live in.

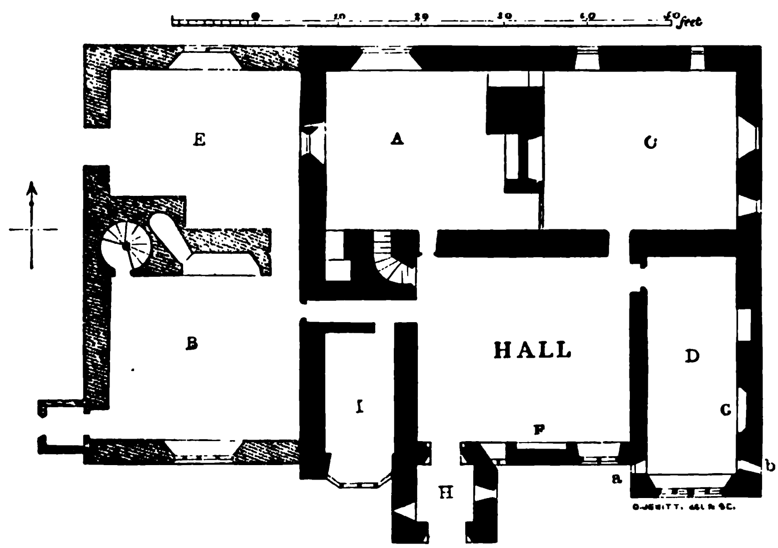
In the fifteenth century a change in the social state of Europe was taking place, which is curiously illustrated by the change of plan in the houses. The feudal system was breaking up. The people, instead of being dependent on a feudal superior who secured their service in return for food and protection, were becoming independent. Learning and refinement began to affect the upper classes, whose range of ideas had formerly not been materially wider than that of their dependants. The common hall began to lose its importance. The inconvenience of showing before the dependants a luxury of living which could not be shared with them began to be felt. The raised dais disappeared and a private dining-parlour took its place.

[1] Parker, vol. ii. p. 9.

The change is noted in the literature of the time. "In the hall," Piers Plowman says:

> "The lord ne the lady lyketh not to sytte
> Now hath eche syche a rule to eaten by himselfe
> In a privee parlour . . . and leave the chief hal."

This innovation appears in the plan of Wanswell Court, a small manor-house in Gloucestershire, built probably about 1450 or 1460[1] (fig. 137). The part which should have been the dais is formed into a "privee parlour," D,



Ground Plan.

A Old kitchen.
B Present kitchen.
C Cellar.

D Parlour with small opening on each side of window a and b; b commands entrance over moat.

F and G Fireplaces.
H Porch to hall.

Fig. 137. WANSWELL COURT, GLOUCESTERSHIRE.

where the lord and lady dined alone. It is cut out of the hall by a wall carried half way up, and finished by an embattled wooden cornice, and a flat ceiling supported on moulded beams, the space above being open to the hall roof.

The arrangement shows an imperfect stage of growth.

[1] Parker, vol. iii. p. 268.

The master's table retains its traditional position—it is only screened off. Mr. Parker says that, in Wolsey's Hall at Hampton Court, there was no dais; the dining-parlour is not cut out of it, as in the last instance, but provided for elsewhere, the space of the hall being left unbroken.[1]

This change of national habits was not made without protest. "As muche as ye may," says Bishop Grosteste in his 'Statutes for the Ordering of a Family,' "withoute peril of sykeness and weryneys ete ye in the halle afore youre meyny, ffor that schall be to youre profyte and worschippe."[2]

Even in the early days of Queen Elizabeth it was considered a good household precept that "all eatinge in chambers should be prohibited, other than such as are ordynarely allowed to kepe chambers." Henry VII. dined in his bedroom—the bishop on one side, the queen on the other; *if the room was large enough*, he might command a lord and lady to dine with them.

In the beginning of the sixteenth century few houses were without a dining-room entirely detached from the hall; but the practice was still considered improper. By the ordinance of Eltham (1526) it is complained that "sundrie noblemen and gentlemen and others doe much delighte and use to dyne in corners and secret places, not repayring to the king's chamber or hall."

Still the great halls continued to be built, partly for use (other than lord and dependants dining together), more perhaps from old habit. Great castles of the fifteenth century, where a number of men-at-arms were kept, still retained their halls. Sometimes even there were several, so as to separate the soldiers from the family and different ranks and bodies of the men from each other. In France, in the fourteenth and fifteenth centuries, the halls occupied

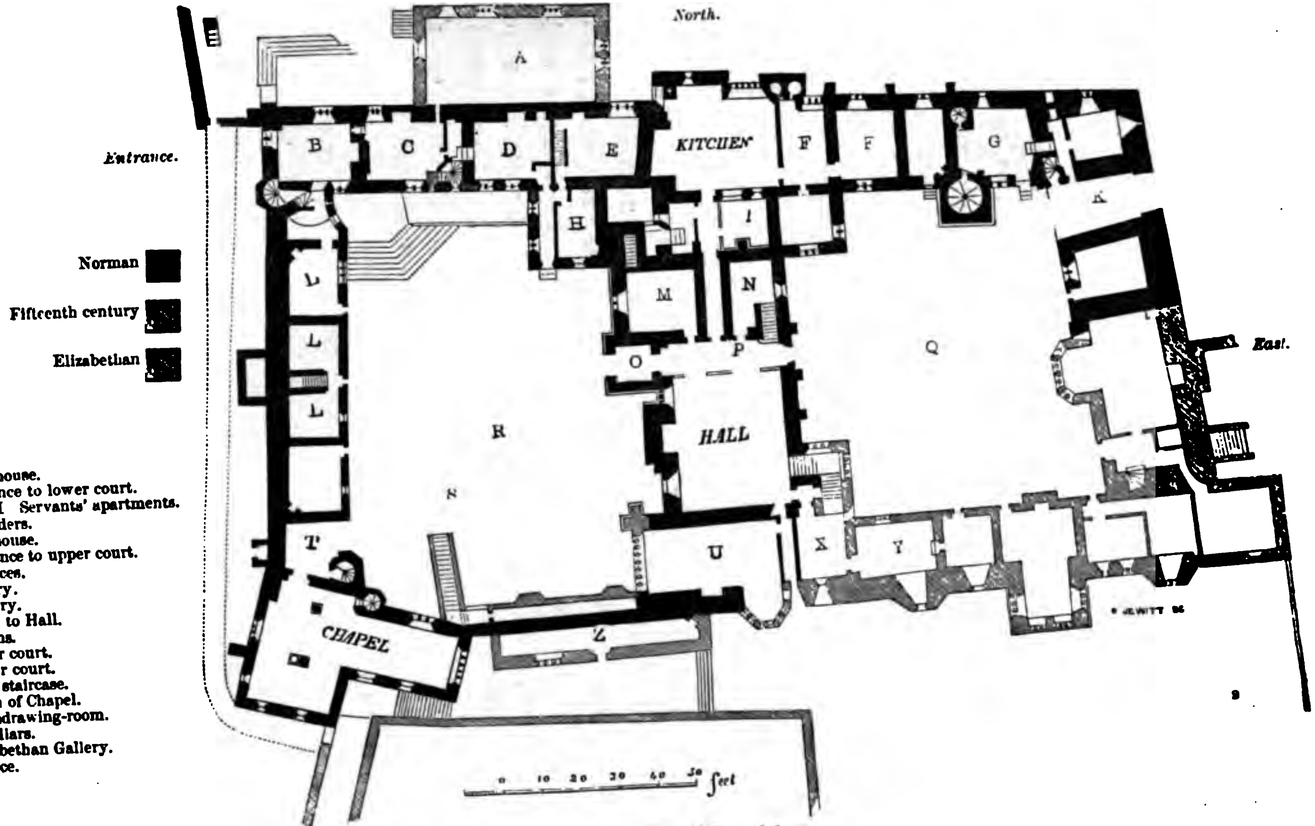
[1] Parker, vol. iii. p. 54. This hall has a dais now; an instance, unless Mr. Parker is inaccurate, of the manner in which the restorers all over the country have been destroying its historical records as evidenced by its old buildings.

[2] Ibid., vol. iii. p. 75.

by the hired men-at-arms, who could not be trusted like the old feudal retainers, were so planned that there was no direct access from them to the defences.

Even in the time of Charles I. some noblemen still lived in the old baronial style, and the hall still retained something of its old importance. In this reign Henry Somerset fifth Earl of Worcester lived in great magnificence at Raglan Castle, in Monmouthshire. The castle gates were shut every day at eleven o'clock in the forenoon, when dinner was served with all the formalities of the old style, the places being ordered according to rank. Two tables were set in the dining-room, at the first of which the earl dined with his sons and family, and such of the nobility as happened to be visiting him; waited on by Sir Ralph Blackstone the steward of the household, the comptroller with his staff, the sewer, &c., and many gentlemen's sons who waited on his lordship, some of them men of estates worth from £200 to £500 a year, who were bred up in the castle. The second table was occupied by knights and gentlemen. In the Hall were three tables, all marshalled in strict accordance with the rank of the guests. The steward presided at the first table, where sat others of the chief officers of the household, and gentlemen under the degree of knight. The second table was occupied by the sewer, with the gentlemen waiters and pages to the number of twenty-four. At the third table the clerk of the kitchen dined, together with the yeomen of the household. There was a private table for the gentlemen of the chapel, and two tables in the housekeeper's room for the ladies' women. There were, besides, menial servants to the number of one hundred and fifty. Every department was regulated by its proper officers.

When the Civil War broke out, the Marquis, besides his own household, maintained a garrison of eight hundred men in the castle. One wonders where they all slept.



A Brewhouse.
B Entrance to lower court.
C D E H I Servants' apartments.
F F Larders.
G Bakehouse.
K Entrance to upper court.
L L Offices.
M Pantry.
N Buttery.
O Porch to Hall.
P Screens.
Q Upper court.
R Lower court.
S State staircase.
T Porch of Chapel.
U Withdrawing-room.
X Y Cellars.
Z Elizabethan Gallery.
a Terrace.

Fig. 138.

Plan of Ground-floor.
HADDON HALL, DERBYSHIRE.

The plan of Wanswell Court is interesting in another point of view, as exhibiting an advance in the science of planning.[1] Hitherto the practice had been to have only one range of rooms under the roof. Here we have a double house; the hall to the front facing south, with a parlour at each end, D and I; the kitchen and cellar to the back. It is probable that there was a passage formed in the usual way by a screen, from the hall door to the kitchen door, which would be removed when the kitchen was altered to B. The cellar as usual enters from the hall, with the view, I imagine, of enabling the lord or mistress to keep an eye on the beer.

In the fifteenth century the desire for comfort and for retirement was increasingly felt. Instead of one room serving several purposes, chambers designed for special uses became more numerous, and planning consequently more intricate. The plan of Haddon Hall is of this date (about 1427), although added to in Elizabeth's time. For comparison with it, as showing the features of French arrangement, I give from Viollet-le-Duc's work the plans of Jacques Cœur's house at Bourges, built about 1443. In the latter there is a greater amount of refinement and contrivance, which the difference of date alone will not account for.

At Haddon (fig. 138) the buildings form two courts divided by the hall, with its porch and screens, O and P; with the pantry and buttery, M and N, and kitchens attached to it at one end; and a withdrawing-room, or private dining-room U (to which new windows had been added in the sixteenth century), at the other end. A stair, opening from the hall at this end leads to a splendid range of Elizabethan galleries facing the south, X, Y, &c. The planning of the rest of the house is of the simplest character—a series of rooms

[1] The older part of the house is indicated in black. The wing at the west end, shaded light, is modern, and must be left out of consideration in judging of the plan.

entering from these courts, with doors of communication between some of the rooms.

In the French example, as in this, there is only a single row of rooms under the roof. At Haddon, to get from one room to another, we must go out into the open air; while in the Bourges house, by means of admirably-arranged stairs and passages, there is complete communication under cover, and at the same time isolation of the different parts.

The site of Jacques Cœur's house (figs. 139, 140, and frontispiece) was part of the old ramparts of the city; the old towers, distinguishable on the plans by their thick walls are amalgamated with the new building, which is skilfully arranged to suit the irregular shape of the ground. Notwithstanding the irregularity of the site, the principal rooms are all of regular geometrical form. The architects of that day understood well that right angles everywhere, especially in a court-yard or street, were not necessary to architectural grandeur; but that at the same time the rooms should be of regular and symmetrical shape. We take the opposite course, making our streets and courts rectangular, the rooms inside the building any form they happen to turn out. The house is at the back of the site, farthest from the street; round the other sides are galleries enclosing a central court. The *salle à manger* about the same size as the Hall at Haddon—forty by thirty feet (both plans are to the same scale)—is in the centre of the building. The principal entrance to it is by the porch in the octagonal turret, the stair in which brings it into communication with the great hall above it (plan of first-floor) and the dwelling rooms on the first-floor, with which also there is communication by a smaller private stair and passages from the inner end of the *salle à manger*.

The service and kitchen arrangements are very perfectly planned. Entering from the *salle à manger*, is a large room

JACQUES CŒUR'S HOUSE AT BOURGES.

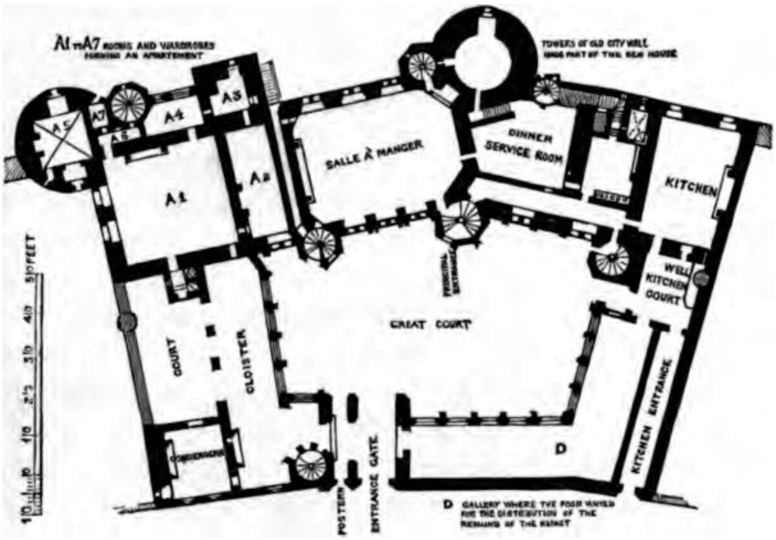


Fig. 139. PLAN OF GROUND-FLOOR.

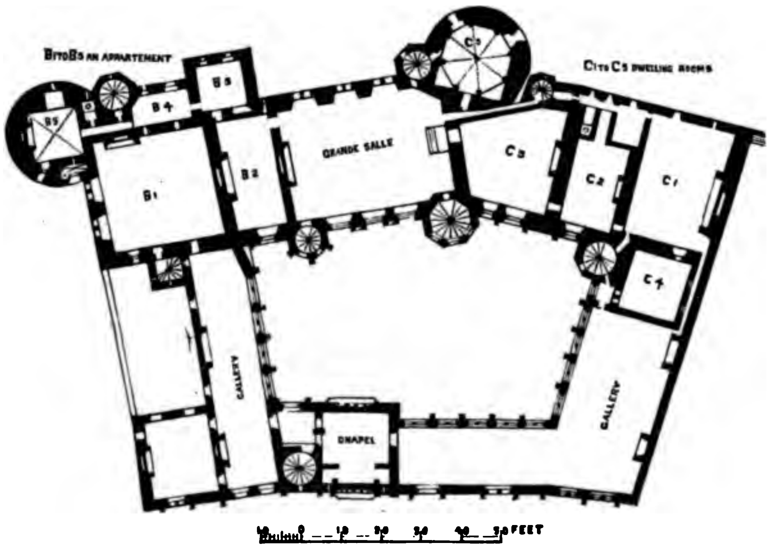


Fig. 140. PLAN OF FIRST-FLOOR.

into which the dishes were brought from the kitchens for service. This serving room or pantry communicates with the kitchens and back kitchen, and from it a stair leads to the musicians' gallery, a niche in the corner opposite the entrance. The kitchens have a separate entrance from the street by the passage on the right. At the other end of the house, on the ground-floor, is an *appartement* (in the French sense), a complete little house with its *salle* A, entering from the cloister, with its inner rooms A_2 to A_6 and its *garde-robe* A_7.[1] The square stair in the corner of the court connects it with a similar *appartement* over it, which forms a suite of retiring-rooms to the *grande salle* on the first floor.

Over the kitchens are two sets of chambers C_2 with C_3, and C_1 with C_4, each communicating directly with the *grande salle.*

Over the entrance from the street is the chapel, which, for the access of those not living in the house, could be entered by the stair directly from the street. This entrance with the chapel window over it are shown in the frontispiece. The communication to the chapel for the family is by the upper range of galleries, enclosing the court.

The cloister D was for the poor to wait in while the broken meat of the repast was distributed to them from the kitchen, according to the good old custom, which held in England also. "Commande ye," says Bishop Grosteste in his rules for the ordering of a family, "that youre almys be kepyd, and sende not to boys and knafis, nother in the halle nother outh of ye halle, ne be wasted in soperys ne dyners of gromis, but wysely, temperately, and withoute bate or letyng be hit distributed and deportyd to poure men, beggers, syke folke, and febull."

[1] This word, in the Middle Ages, both in France and England, was used both in the sense of our word "wardrobe" and in that here intended, probably because the same apartment served both purposes. In France it continued to retain the latter signification.

With the exception of the alms-cloister and chapel, the house is perfectly suited to French habits of the present day. It is planned with consummate skill, working out elegantly and simply a number of complicated problems. The execution of the work and the art throughout are admirable.

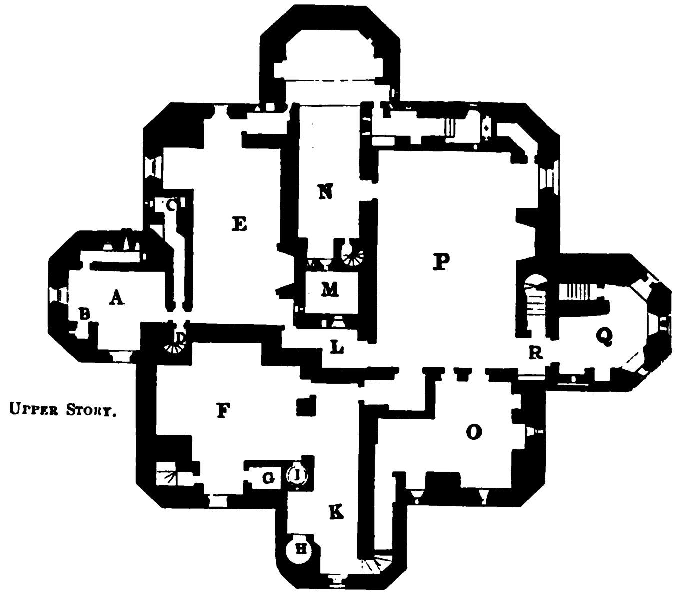
Warkworth Castle (which is of the same date as the Bourges house, having been built by Henry Percy, the son of Hotspur, between 1435 and 1440) shows skill in planning, and advancement in domestic arrangements in England.

The plan (figs. 141 and 142) is very curious. The castle is built on the foundations of the old Norman Keep, built in the end of the twelfth century (1159–73), and in its lower story utilises the old walls. The plan is a square with a projection on each face, a form found occasionally in other Norman keeps, which, however, were usually a simple square. The most interesting feature in the plan is the well for light in the centre, M in upper floor, D in lower floor—the same necessity causing the introduction of this feature here, as in the great blocks of modern buildings in Paris and London.

The requirements of a nobleman's house of the fifteenth century are skilfully fitted in to the singular form of the old keep. It was an excellent characteristic of builders in former days that they never destroyed old work when they could adapt it to their new requirements.

The dwelling rooms are all on the upper story, which, for the smaller apartments, is divided into two floors. The old Norman basement, of which the thick walls remain (fig. 142), was utilised for vaults and cellars and water-tanks. The entrance to the castle is by the steps A, through the porch B, into the lower hall G. Beside this hall is the guard-room E (under which is the dungeon), and off

WARKWORTH CASTLE, NORTHUMBERLAND.

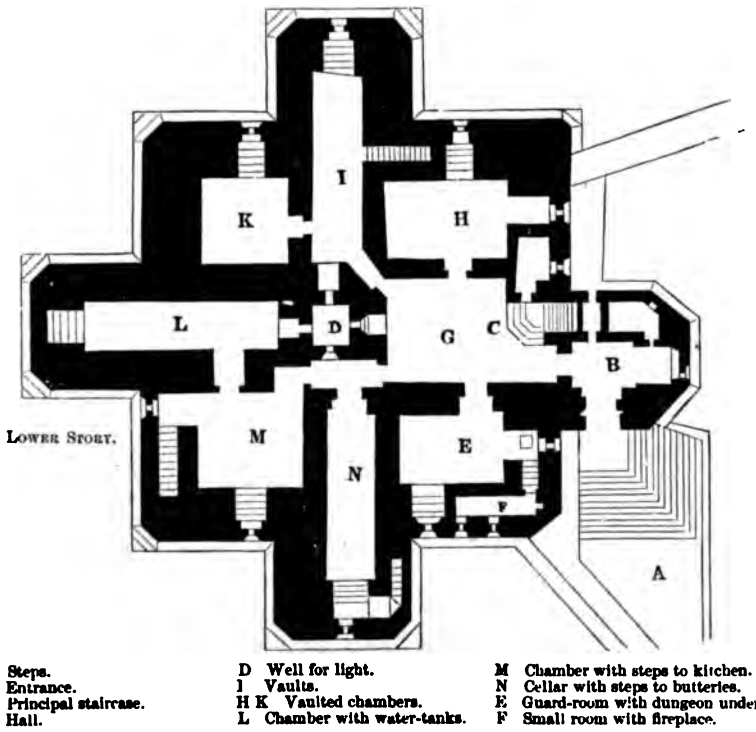


A Ladies' apartment.
B Fireplace.
C Garde-robe.
D Stairs to roof.
E State chamber.
F Kitchen.

G Pantry.
H Oven.
I Boiler.
K Outer kitchen.
L Passage in continuation of screens.

M Well for light.
N Chapel.
O Butteries.
P Great hall.
Q Waiting hall.
R Landing from staircase.

Fig. 141.



A Steps.
B Entrance.
C Principal staircase.
G Hall.

D Well for light.
I Vaults.
H K Vaulted chambers.
L Chamber with water-tanks.

M Chamber with steps to kitchen.
N Cellar with steps to butteries.
E Guard-room with dungeon under.
F Small room with fireplace.

Fig. 142.

the guard-room a small chamber F with a fireplace, probably the bedroom of the captain.

From the hall G the principal staircase C ascends, landing on the upper floor at R, with a waiting hall Q on one side and the great hall P on the other. At the inner end of the hall is the entrance to the chapel N, which has a little oratory or priest's chamber attached to it behind the inner wall of the hall. By the passage L (which is lit from the well M, and which was a continuation of the screens at the end of the hall) the state-chamber E is entered, which, like the hall communicates with the chapel at its inner end, and would thus have a private entrance to the hall, through the chapel. A little porch at the outer end leads to the *garde-robe* C, the ladies' apartment A, with its fireplace B, and the stairs D, to the roof, which was flat and used as a promenade. There was probably a screen, lighted by the little window into the well M at the outer end of the state chamber E, which would give it privacy from the traffic to these places.

The kitchens F and K (fig. 141) communicate with the "screens" of the hall, and, by a stair in the corner, with the room M, under them in the lower story. The apartment O occupies the usual position of the butteries and has a separate stair to the cellars in the lower story.

In the planning and arrangements of Warkworth Castle we find almost every expedient of modern planning admirably applied.

Thornbury Castle, in Gloucestershire, is an interesting example of planning, the more valuable as a record, that, never having been finished, it remains as it was built, without later additions or alterations. It was begun in 1511, the second year of the reign of King Henry VIII., by Edward Stafford, Duke of Buckingham, and was left unfinished when he was beheaded in 1522.

It shows much the same character of planning as the

Bourges house, although it is sixty years later. In it also there is but one range of rooms under each roof; with an occasional passage giving communication without encroaching on the privacy of some of the rooms ; a similar profusion of turret staircases, and a similar gallery leading from the private apartments to the chapel.

There are several great courts, and the plan covers an immense extent of ground. But, notwithstanding the amount of building and the architectural magnificence, the accommodation is not great. The rooms may be larger, but they are not more numerous than in many a country house. Notwithstanding the number of staircases and the skill with which they are disposed the house is after all only a collection of separate houses, access between which could be got only by going outside. We still find this arrangement sometimes at old inns, where we have to cross a courtyard to get to the public room.

In Queen Elizabeth's time immense improvements were made in house-planning. Building splendid mansions became the fashion. Never before, it was remarked at the time, had there been seen such luxury in houses. Nothing else was built. The old faith, which had found its expression in the architectural grandeur of churches, even in countries where it still prevailed, found the existing churches more than sufficient for its needs. Lord Bacon's essay, entitled 'Of Building,' gives no hint that anything could be built but houses. The country is still full of them—the most charming residences it has. In the grandeur of their disposition and of their apartments, in the richness of their decoration, carried out consistently into the smallest details of fitting and furniture, in their harmony with the scenery, and above all, in their pleasant homelike character, they surpass anything we can attempt or almost hope for, notwithstanding all our boasted superiority.

In Elizabeth's time the system of planning was revolutionised; the house, however large, was made *one* by connecting all the parts together by means of corridors or galleries, which were often its main architectural features—wide and stately, lighted along the sides by stained glass windows.

Another feature introduced in this century into English houses was the great open staircase with carved oak banisters. "The stairs to the upper rooms," says Lord Bacon in his essay on building, "let them be upon a fair open newel, and finely railed in with images of wood cast into a brass colour, and a very fair landing at the top."

But the old turret staircases are still in use: "In all the four corners of that court fair staircases cast into turrets on the outside, and not within the row of buildings themselves."

Bacon's essay, although I have failed in following its directions in constructing an actual plan, and doubt, in fact, if Bacon intended any definite plan, shows us the grandeur of ideas prevalent at the time. "You cannot have a perfect palace except you have two several sides—a side for the banquet, as is spoken of in the Book of Esther; and a side for the household: the one for feasts and triumphs, the other for dwelling, &c." "I would have on the banquet side, in front, one only goodly room above stairs, of some forty foot high, and under it a room for a dressing or preparing place at times of triumphs." This room was to be equal in size to the hall and chapel, themselves "of good state and bigness," with the summer and winter dining-rooms on the other side of the central tower—all together forming one side of a square court, with another court of the same size, behind it. "The row of return on the banquet side, let it be all stately galleries, in which galleries let there be three or five fine cupolas in the length of it, placed at equal distance, and fine coloured windows of several works;

on the household side, chambers of presence and ordinary entertainments, with some bedchambers: *and let all three sides be a double house* without thorough lights on the sides, that you may have rooms from the sun both for forenoon and afternoon."

This system of a double house, or double row of rooms under one roof, marks a decided advance in planning—the abandonment, in fact, of the Gothic single house, and the adoption of the present modern system.

"The inner court" was "to be for privy lodgings on both sides, and the end for privy galleries; whereof you must foresee that one of them be for an infirmary, if the prince or any special person should be sick, with chambers, bedchamber, anticamera, and 'recamera' (or retiring-room) joining to it: This upon the second story. Upon the ground story, a fair gallery open upon pillars; and upon the third story likewise an open gallery upon pillars, to take the prospect and freshness of the garden." "As for offices, let them stand at a distance, with some low galleries to pass from them to the palace itself."

In this sketch of Bacon's there are several evidences of Classic influence, which, it must be remembered, had already been active for about a century in other parts of Europe. The Vatican and Escurial, and the Classic châteaux of Francis I., had been built, and were well known to Bacon, though the style was not adopted in England in its purity till the time of Charles I.

These open galleries, which Bacon conceives as adorning his ideal palace, became a feature of English planning. They long continued, in a more homely form than Bacon thought of, a feature of old inns, which, somehow, retain old features of plan for several generations, after they are otherwise extinct. I give an example of one of those old inns in London, now pulled down (figs. 143, 144), for the use

Fig. 143. THE OXFORD ARMS, WARWICK LANE.

of which, I am indebted to the kindness of the proprietors of 'The Graphic.' These inn court-yards were our earliest theatres; the level of the court was the pit, the galleries were the boxes, the rooms behind being used as retiring rooms, which, according to the Puritans, when they put down play acting, gave sometimes occasion of scandal.

Fig. 144. GALLERY IN THE OXFORD ARMS.

The Classic principle of symmetry was thoroughly recognised in Elizabethan architecture. In Bacon's palace one side answers exactly to the other; and, from that time till lately, on the revival of Gothic ideas, symmetry remained a principle of English planning.

In the designs of Inigo Jones, the principle is carried to its uttermost limits. In his design for Whitehall, not only the architecture is symmetrical; but in the plan everything is double: two throne rooms; two private closets. Those apartments in double were utilised as the King's side and the Queen's side, but it is difficult to believe that it was an arrangement suggested solely by convenience, and not by a passion for symmetry, so deep that it was carried into

arrangements of plan, which could never possibly be visible in the actual building.

In the plan of Versailles there is the same symmetry and grandeur of arrangement: the centre of the front, the point round which everything was arranged, being the bedroom of the King.

The plan of Amresbury (figs. 145–148) is a fair specimen, on an ordinary scale, of the ideas of planning of Inigo Jones, and of his time. The elevations are given in the first volume, but I repeat them in this place, as they make the plan somewhat more intelligible. In its general features it remained for a century or more an ordinary type for the plans of English houses.

The main feature on the ground-floor is the hall B, thirty-five feet by twenty-two; a reminiscence of the old English hall, modified by the Italian feeling which considered the ground-floor not so much useful in itself as a support to the more important floor above. This hall must be dark; the porch shuts out great part of the light, and is mainly useful not in itself, but as a base to the portico above. The hall, crossed by lines of traffic, would not, according to our notions, be a comfortable room. Nowadays we should make this entrance-hall smaller, and give the space to one or both of the rooms on either side, A or C; but that would be contrary to the idea of this plan, which is to have the large room in the centre, and smaller rooms on each side.

It is difficult to guess the distinctive purpose of the different rooms. I imagine K to be the kitchen, with communication under the great stair to offices G, F, E, and so to the back entrance, through the passage M. The arrangement of the back stair, within the great stair, is clever, and prettily carried out in the cupola on the top (fig. 146); but it is not convenient. The object of back stairs is to keep the traffic separate, but, from its position

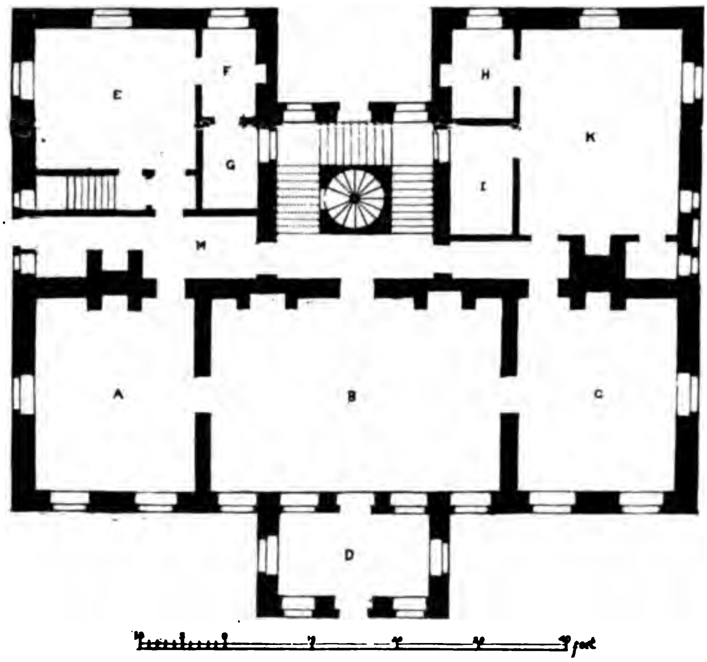
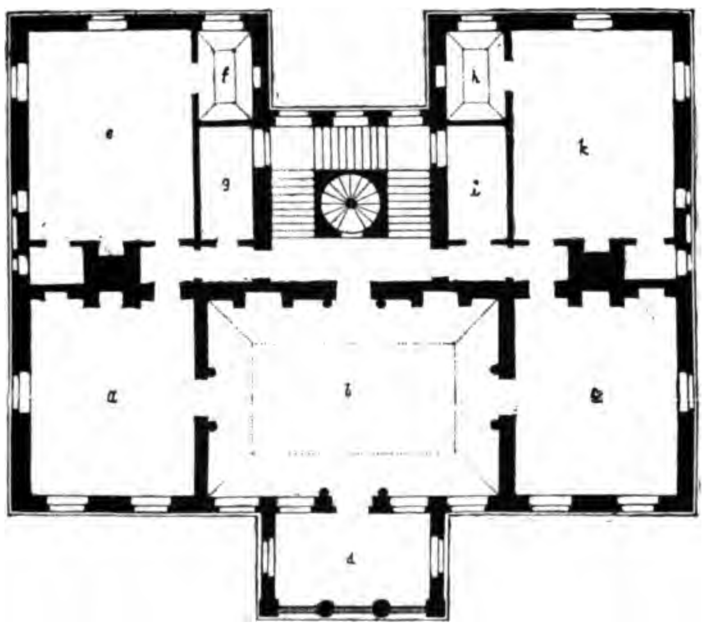


Fig. 145. GROUND FLOOR.



FIRST FLOOR.

Fig. 146. PLAN OF AMRESBURY. Attributed to Inigo Jones.

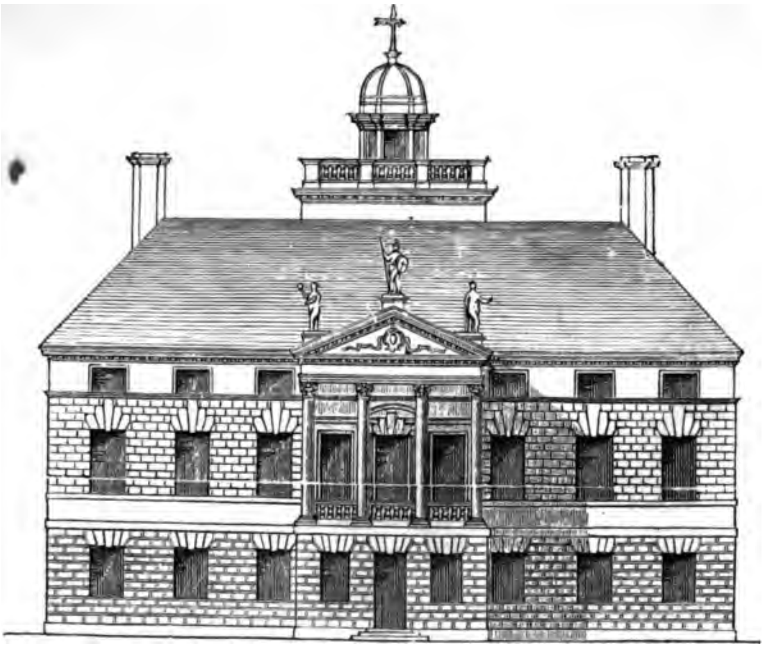


Fig. 147. AMRESBURY. FRONT ELEVATION.

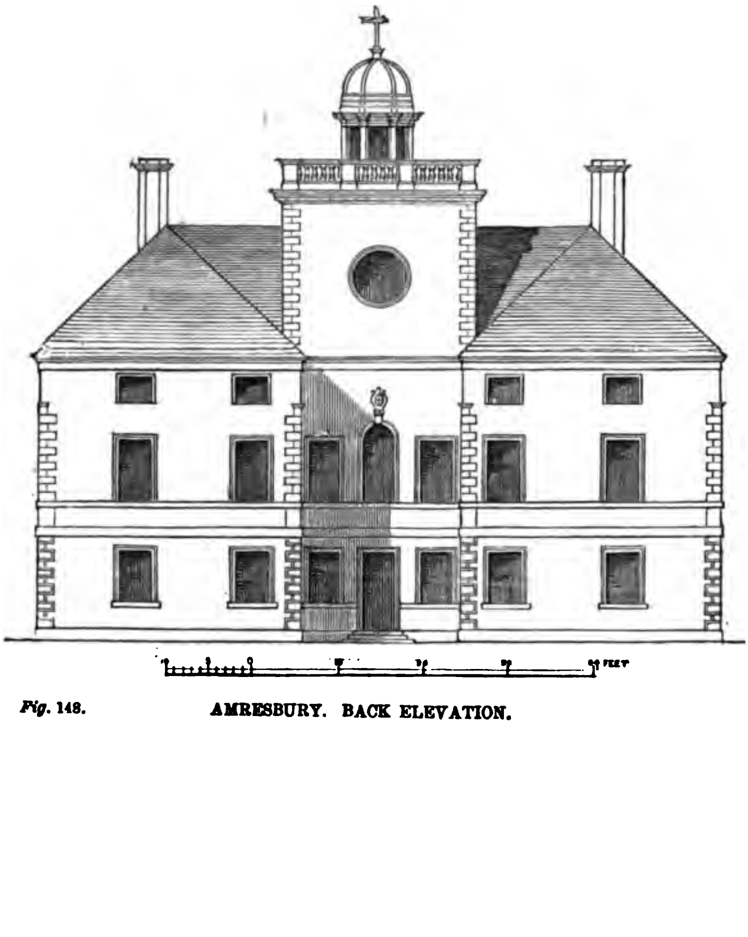


Fig. 148. AMRESBURY. BACK ELEVATION.

here, the back-stair traffic must always emerge on the main corridor. It looks as if the *raison d'être* of the arrangement was the cupola on the top.

The upper floor is perfectly symmetrical in plan; closet even answering to closet. It has a splendid range of reception-rooms in front, the central hall rising through two stories. The bedrooms of the house are on the floor above.

The Gothic revival, which Horace Walpole inaugurated at Strawberry Hill, broke through the principle of symmetry. In the castles and abbeys then built, irregularity was not only admitted, but sought for as an element of picturesqueness; but this was still exceptional, and was considered fantastic. Symmetry was still the rule, and ordinary people considered (possibly with justice, from the experience they had) that a house must be uncomfortable to live in unless it had an equal number of windows on each side of the door. Through the influence mainly of the more modern Gothic revival, this notion of the necessity of perfect symmetry—the unreasonableness of which was one of the most telling points of the able writers who supported the movement—is now everywhere given up except where the highest stateliness and grandeur are aimed at, in which case it may be essential, whatever the style. In dwelling-houses, of whatever size, even in the Classic style, there is no attempt at it, they have towers in odd corners and the door out of the centre. Convenience, not symmetry, is now the universally acknowledged rule in house-planning.

Mr. Kerr asserts that both the Classic and Gothic principle of planning still prevail in modern practice, and gives examples of his own designing in illustration. "That all Classic motive," he says, "is based on regularity, and all Gothic on irregularity, is still a first principle; but" (he has to admit) "the Classic manner may pervade a

plan in spite of irregularity in detail, and the Gothic manner similarly in spite of symmetry." In fact, of his two specimen plans, the Gothic one, with the exception of some little irregularities of bow windows, which are not essential to it, is more regular and symmetrical than the Classic one. Even Bridgewater House, the specimen *par excellence* of Classic design in our day, is irregularity itself compared with one of Inigo Jones's plans; so is Osborne, another of Mr. Kerr's instances of Classic planning.

A modern plan may have Italian features, such as a saloon and double staircase; or Gothic ones, like a dining-hall with dais and screens. In the several parts of a Classic house, symmetry may be more attended to; but perfect symmetry, which required that every part should be balanced by another exactly like it, which was the *principle* of Classic planning, is completely abandoned. No one will sacrifice anything now for that idea. Happily, modern planning exists, with its established rules and requirements partaking of both, but different from either.

What these are we now proceed to show.

CHAPTER II.

CHARACTERISTICS OF MODERN PLANNING.

OF the characteristics of the planning of modern English houses, the most striking, when compared with the planning of former times, is its *Multifariousness.* Keeping pace with our more complicated ways of living, we have not only increased the number of rooms, in ordinary houses, but have assigned to each a special use. Instead of the hall and single chamber of the middle ages, with which even kings were content, every ordinary house must have a number of separate bedrooms, at least three public rooms, and a complicated arrangement of servants' offices.

Secondly, The plan must give *Isolation* to the several parts. With our present habits we could not live in those old palaces, in which the only communication for a suite of twenty rooms, is by passing through each in succession. We must have separate communication to each room. This is a special characteristic of modern planning in England as compared with France, where the ordinary and regular entrance to one room is through another, a mere backway

or *dégagement* by a dark narrow passage being provided for service. With us, from our love of seclusion and retirement, each room must be isolated. A room loses its value to us if it is a passage to another. The dining-room must be capable of being shut off from the rest of the house, communicating during dinner only with the kitchen. The dinner should not have to be carried past the drawing-room door, or through the hall and public passages, and the kitchens must be so placed that their smells and noise do not invade the house.

The servants' part of the house, again, is shut off from that of the family; and the various servants are isolated among themselves. The laundrymaid must not have to carry her wash through the kitchen, the housemaid must be able to do her work without interfering with the butler, the nurses must be independent of the other servants; otherwise occasion will be given for that love of quarrelling, which, next to love of dress, seems a characteristic of modern servant nature.

Thirdly, *Unity.*—There must be communication between all the several parts of the house under one roof-shelter. It must be one house, not several.

Fourthly, *Convenience.*—The house should be as far as possible so arranged that we have everything we want beside us when it is required, that we have not perpetually to traverse long passages, or go up and down stairs. A boudoir should be between the lady's bedroom and the drawing-room; a bathroom should be beside bedrooms, and dressing-rooms should enter off them. They should have an entrance also from the public passage, so that the servant may enter them without passing through the bedrooms.

In the servants' department especially, by convenient arrangements, immense labour may be saved—an object of very great importance, not so much to prevent the servants being overworked (the danger of this is not at present

great), but that the house may be managed with fewer of them. For instance, it is usual in London houses to put the pantry on a different floor from the dining-room. Each time a glass or spoon is wanted, two ascents of the stair have to be made—1st, to know what is wanted; 2ndly, to get it. And each time the hall door has to be opened, the stair has to be mounted—necessitating often the keeping of two servants where with better planning one would suffice. Such contrivances as speaking-tubes throughout a house save labour, and consequently may diminish the number of servants; so do coal-stores, and taps for drawing hot and cold water, on each floor.

Fifthly, *Compactness and Simplicity.*—All space occupied in passages is lost, increasing the size without adding to the accommodation of the house. A straggling house is often picturesque, but numerous staircases, needless corners, and tortuous passages add much to the trouble of keeping clean.

In perfect planning expedients should never be obvious—no steps down into rooms, no corners cut out of apartments, leaving them an irregular shape, to form closets or give headway for stairs. The difference of floor-levels, caused by the difference of height proper to public rooms and offices, should not be thrust on the attention, but should be reached, not by steps specially provided, but by landings from the ordinary stair. The parts into which a house is divided should not be unnecessarily multiplied. If a number of rooms can be made to enter out of one hall, it is better than having a separate passage to each. One good staircase with square landings and no turned steps, is better than a number of indifferent ones stuck on as they happen to be needed.

Adding parts anywhere as they are wanted gives an appearance of complication, and seems an evidence of cleverness; but it is really much harder to make each part come naturally into its proper place without the appearance

of effort. And the result will repay the trouble, for not only will the house be more convenient, but the architectural effect will be nobler. To produce simplicity out of a number of complicated requirements is the last effort of art—the art which conceals the art.

Sixthly, *Light and Air.*—Another essential of good planning is that there be light and air everywhere—no stairs and passages where one must grope his way in the dark, or requiring a perpetual gas-jet burning in them. Nor should "borrowed lights" be taken from dwelling-rooms. A passage may be lit from a staircase or pantry, but glass doors or borrowed lights in a sitting-room or bedroom destroy their privacy and produce a sense of discomfort.

Seventhly, *Warmth.*—A house should be so arranged that there be no waste of heat. Cold draughts of air through it should be avoided. The outer door should not enter directly into the hall, but into a porch or vestibule—if possible round a corner, so that when opened there is not a straight draught through, with a swing door which will shut of itself when the outer door is opened. In sitting-rooms the fireplaces should be so placed that we can sit at them out of the way of draughts from doors and windows. In bedrooms a similar position should be arranged for the bed, as by so doing we can have better ventilation by permitting the entry of more fresh air into the room. The heat of the fireplaces should not be wasted by their being placed in outside walls, where one-half of it goes to warm the external air; but in inside walls, so that the spare heat may increase the general warmth of the house.

Eighthly, *Aspect and Prospect.*—It would be an error, on a site whence good views can be had, to place the public rooms where these views could not be seen. But it is even a greater error to give rooms a wrong exposure or aspect—to make a drawing-room face north-east, where it would never see the sun; or a dining-room to the west, where the

level sun in summer evenings at dinner-time enfilades the whole room, and compels the blinds to be completely closed; or to make the entrance open towards the stormiest point of the compass. For a dressing-room a south-eastern aspect is the pleasantest, with the sun shining into it when we get up.

Ninthly, *Architectural effect* is essential to a perfect plan. It must be such that the elevation raised from it will be good in architecture, whether grouped irregularly or governed by symmetry. In many Classic buildings the desire for symmetry influenced the plan to such an extent as to be often destructive of convenience; as when kitchens were placed at the extremity of a long wing on one side of the house, to harmonise with the stables on the other. Sometimes in Classic plans, symmetry is carried out in parts where it could not be seen in the actual building (see plan by Inigo Jones, fig. 145), under the notion apparently, that a plan should be made a pretty thing to look at on paper. In actual work this would be expensive trifling What is wanted is, that in arranging the plan, the architectural effect, internal and external, should be considered. When Classic regularity and symmetry are aimed at, the plan must bend to these; but convenience ought not to be sacrificed, and if care and thought be given, it need not. Even when convenience is the ruling principle and irregularity is permitted, the arrangement must often be modified for the sake of the architectural effect.

Among the list of essentials of modern English planning, Mr. Kerr includes *comfort*, which ought, doubtless, to be the special characteristic of a good house. But its attainment is the result not of any single essential, but of the union of all. Warmth, light, privacy, convenience, a proper number and distribution of rooms, and a suitable aspect for each are all essential to it. So are other qualities not included in good planning, such as good construction; that the floors

be strong and the roofs water-tight; that there be no damp or smells, no smoky chimneys, and no harbour for vermin.

The requirements enumerated, and others varying with circumstances, must be fulfilled in perfect planning. It is always easy to attain some of them. The difficulty is to get all at the same time. In some cases it is impossible; we have to choose between a balance of disadvantages. But the hardest problems, the most incompatible requirements, will often yield to the capacity for taking trouble, to the search among the infinite number of possible combinations for that which unites most advantages.

If we multiply the inconvenience of a badly-planned house by the lives of its occupiers during the hundred years or two of its existence, it is obvious that to spare the trouble that might have made it right at first is reckless waste.

CHAPTER III.

THE FAMILY LIVING ROOMS.

BEFORE attempting to explain the arrangement of a modern English house, and how the different parts of it should be combined, we must know what its various parts are; their use and purpose, and the size and space required for each. In doing this there may be no great scope for telling much that is new, but some points may be suggested which a non-professional reader may not have thought of, or which, though not new to architects, may afford matter for discussion.

The number of apartments, varies of course with the style of living kept up—from the two-roomed cottage of a day-labourer, or the house of a small tradesman with its single parlour, to mansions with ranges of reception-rooms, libraries, billiard-room, and suites for guests; comprising sometimes several distinct divisions—one for the family to live in, another for entertainments—"a side for the banquet and a side for the household," as Lord Bacon puts it—besides the division for the servants.

It will be most convenient to take as the basis of enumeration the requirements of the upper middle class, who occupy the ordinary houses of the streets and squares of our towns, including all that is necessary to the comfort and refinement of modern life—not as modified by the habits of town life, or the restriction of town sites, with the rooms piled one above another in half-a-dozen stories, but with the freedom of disposition of a country house, with the day-rooms all on one floor. On this as a groundwork it is easy to add the requirements of larger mansions, where greater style or more extended hospitality is kept up.

The parts of such a house may be divided into day-rooms, bedrooms, nurseries, conveniences including closets bathrooms &c.; servants' offices, and thoroughfares or the connections between all these parts, comprising hall, corridors, passages, and stairs.

In large establishments, in the servants' department, a separation is made into male and female servants' divisions, with upper and lower ranks in each. In some cases, in addition to the rooms for the household, there is a distinct class of state rooms, appropriated to great entertainments, too large to be comfortable for ordinary family life.

In houses where many visitors are entertained, the rooms for the family—consisting of the master's and mistress's bedroom and dressing-rooms, and private sitting-rooms—are kept apart, if possible on the principal floor, with the nurseries over them, forming a separate little house with its own stair.

THE DAY-ROOMS.—The day-rooms called for by English middle-class habits are, at least, three—a dining-room, a drawing-room, and a third room of smaller size, variously termed parlour, study, library, or breakfast-room. Larger houses may have each of those several rooms, with two or more drawing-rooms, boudoir, saloon, music-room,

billiard-room, smoking-room, gentlemen's room, and gun-room in addition.

It is questionable, however, whether such a multiplication of the number of rooms, all free to the family and visitors, adds anything to the true comfort of life. We can, after all, only be in one place at a time. Empty rooms make a dreary house; nor does a great number of public rooms contribute to privacy, for there is no real retirement in apartments open to all the family and guests, and even on occasion to servants. It is better, with the increase of the household, to increase the *size* than the *number* of the public rooms.

The Dining-Room might more accurately, if less elegantly, be called the eating-room, the *salle à manger*. In it, in most houses, all meals are taken; few families finding the necessity of a separate room for breakfast or lunch. In some houses the room is used for no other purpose. In others it is also the family sitting-room, and the possibility of its being so used should not be left out of account in its design.

In width it must not be less than will contain the table, the chairs on each side, and a passage for the waiter between them and the fireplace and the furniture round the walls. About fifteen feet will suffice for this; with a narrow table and no furniture in the room, even less will do; a width of eighteen feet is ample, though twenty or twenty-two is not too much.

The length will be determined by the proportion to the breadth, and by the number it is desired to accommodate at table. A dining-room fifteen feet wide should be at least eighteen long; one of eighteen from twenty-four to thirty, or more if necessary; one of twenty or twenty-two may be almost any length. Eighteen by twenty-five feet is a very convenient size for all family purposes, will accommodate

eighteen or twenty guests at table; and on special occasions, by an arrangement of narrow tables round three sides, can be made to dine as many as thirty or forty. A bow window at the end of the room, increases the dining accommodation, as it allows the table to be lengthened, which a window projecting from the side does not, though it makes the room pleasanter, and gives an impression of space.

The best position for the windows, unless the room is so long that the farther end would be dark, is at the end, so that the light comes to those sitting at table from the side. When the windows are at the side, the guests on one side have the light in their faces, the others have their plates in darkness from their own shadows. It is an advantage, when the window is at the end of the room, to have a second window at the side, as near the darker end as possible, that the master at the foot of the table may have light for carving.

The proper aspect for the windows will be one from which the sun does not shine in on the guests at meals, necessitating the closing of the blinds. West or north-west is therefore to be avoided, as the level sun at the usual dinner hour would enfilade every corner of the room. The best aspect is from south to south-east: in the evening, at dinner-time, the landscape is seen lighted up from behind; at lunch-time, in the middle of the day, the sun is so high as to be no inconvenience; and in the morning, at breakfast-time, even if it comes in, it is not unwelcome. From north to north-east is not objectionable; in summer it is cool, and the cold look out in winter does not much matter, as the room is shut in in the evenings. But this aspect makes it less pleasant as a sitting-room and for other meals.

A dining-room should have communication with the kitchen, in addition to the family entrance by the hall or corridors, so that dinner should not pass through them,

sending its odours through the house. It should open into a *serving-room* or *passage*, where each course can be collected from the kitchen ready for serving. Here there may be a *hot-closet*, heated by pipes from the kitchen boiler or by gas, for warming plates and keeping the dishes hot till they are required; and, if the kitchen is on another floor, a *lift*, which is a stage or cradle wound up and down in a vertical shaft either by hand or water power, large enough to hold the dishes, for saving the labour of carrying them up-stairs. The servants' stairs should communicate with the service-room; and off it, or beside it, on the same floor, should be the pantry.

The DRAWING ROOM is properly the withdrawing-room or retiring-room of the ladies from the hall, and in old castles has adjuncts fitting it for this purpose. With us this is still its use, in accordance with our custom, which Continental nations consider barbarous, of the ladies retiring to it after dinner, and leaving the gentlemen to drink by themselves. Besides its use in ordinary houses, as the lady's sitting-room and reception-room for callers, it takes the position of the hall of old houses as the place for evening entertainments, for dancing, music and receptions. For the latter purpose it ought to be large, in town especially, where there is no limit to the number of guests; at least wide enough to dance in, leaving room for those sitting round the walls. For this anything less than seventeen feet is cramped; if possible, it should be twenty or twenty-two, or even wider. The length may be anything, from the same as the width, so as to form a square, up to a hundred feet or so, in which case it may be broken into compartments by pillars or wide openings.

As one chief use of it is as a conversation-room, it should be planned to favour the forming of the company into separate groups. Unity of plan, which would be a merit in

a lecture-hall or concert-room, is an error. It should therefore have a number of separate centres, such as deep window recesses or a couple of fireplaces. The best shape is a long room, with several embayed windows along the side. Lighting it from the end alone, will have a tendency to make the company collect there, leaving the darker parts unoccupied. In the newer London houses it is frequently lit from both ends, which gives it the feeling of a tunnel, and produces a peculiarly dismal effect, as the objects in it are always seen in dark shadow against the light.

As a drawing-room should be cheerful, the best aspect will be a sunny one, provided it has not so much window as to make it like a hothouse. Some of its windows may face westwards, so as to give views of the setting sun, which will not cause the same inconvenience here as in the dining-room, where the guests are tied to one place at table and cannot move out of its rays; but in this case it is essential that there should be more wall than window. If the site of the house affords good views of scenery, the drawing-room has a better claim than other rooms to the benefit of them. It should look on the flower-garden, and one of its windows may also look into a conservatory, not for raising plants, but for exposing them when in bloom; between which and the room, to avoid damp and the smell of earth in the house, it is well to interpose a porch or corridor, which will form also a better access to the garden than one of the drawing-room windows.

An object of even more importance than providing views of scenery and abundance of light, and one not always sufficiently attended to, is the necessity of providing sufficient wall-space for the quantity of bulky furniture which a drawing-room usually contains, such as sofas and couches, console-tables, a grand piano, cabinets for curiosities, groups of statuary, stands for folios of engravings, or a bookcase for works on art. With this view, the doors and windows

should be kept some little distance from the corners of the room, so as to leave space for such articles in the corners; and especially the too frequent error should be avoided of making the room a glasshouse—more window than wall, making us feel as if sitting in the open air, hot in summer and cold in winter. With its cold white walls and ceiling, its tawdry finery, and gimcrack furniture, the ordinary drawing-room is often one of the most uncomfortable rooms in the house. In many cases, indeed, it is not intended to be lived in, being much too fine for daily use, the furniture too flimsy or the coverings too costly for wear. Each time the fire is lit, the maid has two hours' work next morning to restore the tarnished brightness of the polished steel grate. Except on rare occasions, the room remains unused, in dignified and dismal desolation, all the more cheerless that it is kept in perfect order—the furniture all swathed in brown holland, everything in its proper place, the books on the round table in the centre of the room (without which, no ladies' drawing-room is considered to be complete), radiated at equal distances round its circumference.[1] It serves its purpose, in producing that consciousness of being as good as our neighbours', in which consists so much of the happiness of life. When this is all the use which a drawing-room serves, the small third room essential to all middle-class houses becomes the family living-room.

The French system of building houses with two day-rooms only— a *salon* to live in, and an eating-room—would be more sensible and comfortable; even the simpler old English custom of one good-sized *hall*, with space for games or a dance when the tables were cleared away after meals, with its little withdrawing-room for retirement or for seeing occasional callers without their intruding on the family, is better than living in a poky little parlour and leaving the

[1] This was written some years ago.

best room in the house unused. I do not venture to recommend its general adoption; but in seaside villas or country summer quarters, where the restraints of society are lightened, where formal morning calls are happily unknown, and neighbours gather familiarly on wet days in each other's houses, the old plan with the old manners might be revived, and one good-sized hall or room be found more convenient than the orthodox three.

In this case some modification of mediæval plan might be necessary. It would not suit our habits that the hall, when used as the family living-room, should be the only entrance to the other rooms; nor should kitchens and butteries be separated from it by the entrance.

But without the house being designed on purpose, the result might be gained by merely appropriating the biggest room to family use, instead of to desolate grandeur.

Our business, however, is not to suggest changes in family habits, but to fit houses to those habits, from whatever motives they arise.

The destination of the smaller third room of ordinary houses will vary with the wants and habits of the family. In some cases it will be used as a morning-room, in other cases it may be the school-room or billiard-room; in others, a library, or the master's private room or study, in which case it will not unfrequently be his smoking-room also.

In larger houses these become separate rooms, each with its special characteristics.

The Morning Room.—Devoted to the private life of the family, should be pleasant and airy, with an aspect to catch the morning sun; in fittings and furniture comfortable rather than splendid.

The Library is frequently connected with the drawing-

room by large folding doors, so as to enlarge the space for receptions, at the risk, however, of the conversation and piano-playing of the drawing-room destroying the retirement proper to it as a reading and writing room. This evil may be mitigated by interposing between the two a small room or saloon, which might be made a passage to the garden. Sometimes a library is made to open into the billiard-room, in which case it becomes a mere gentleman's lounge. To fit it for its proper purposes it should have a position in a quiet corner of the house away from the general traffic.

It may be any size, in shape rather long than square, so that the occupants may be out of each other's way, with retired corners or deep window recesses for quiet reading or writing. In some houses it is the largest room in the house and of splendid proportions. At Blenheim Palace the library is nearly two hundred feet long. The book-cases should be arranged for in the plan, and if possible they should form part of the internal architecture of the room.

It may have almost any aspect; the steady light of north or east, or the warmth of a south exposure. Even the inconvenience of the western sun may be overcome by a recess, with windows at each side and blank wall in front.

The MASTER'S PRIVATE ROOM, if he is a student, will be in connection with the library. In other cases it may be a business-room; with a waiting-room or waiting-passage attached to it, placed near the entrance, and communicating also with the back entrance, so that out-door servants and tenants may have access without coming through the main entrance and hall; and it should have convenient access to the garden, and to the offices and stables. It may be impossible to give the room a position fulfilling all these conditions; a compromise must be made, giving the most

important. Sometimes it is connected with the master's dressing-room, forming a part of the private family suite; sometimes it is his dressing-room, with a washing-room or bathroom attached, the latter arrangement having the advantage of saving a second fire for his dressing-room. It ought to be a pleasant room; not too small, else it becomes either close or draughty. Often, contrary to the text that he that buildeth the house hath more honour than the house, every room is preferred to it, and it takes any odd corner that may be left after the others have been arranged. Sometimes even in large houses no such room is provided, the master feeling no occasion for retirement from his family.

The private room of the lady of the house is called the BOUDOIR (from *bouder*, to pout), being apparently destined in French houses to the very commendable purpose of allowing ill-humour to be got rid of in private. We rather picture an English lady in her retirement engaged in settling her household accounts, in reading, music, sewing, or worsted work.

In position it should be retired, near the lady's dressing-room, and should form a part of the family suite. It may be near the drawing-room, as a retiring-room from it, but it should also communicate with the public corridors, and it should be convenient for the access of servants and others coming to receive orders. It is usually fitted up as a little drawing-room with all possible elegance.

A BILLIARD-ROOM is an essential of most country houses, as a means of killing time on wet days. Its position should be retired, so that men may be at their ease in it smoking and playing in their shirt-sleeves, and to drown the knocking of the balls. The neighbourhood of the dining-room and butler's pantry is convenient. It should

have a water-closet near, and a fixed wash-hand-basin either in the room or in a closet attached, but not in the water-closet. It should, if possible, have a roof-light; but it is well also to have a window for those not playing to look out at, which is best if a bay-window or recess. When lit by windows in the walls they should be high, and if possible on more than one side, to prevent the balls casting shadows, which makes an accurate stroke difficult. Its proper size is twenty-four feet by eighteen; twelve feet by six for the table, and six feet, the length of a cue, clear all round it. It may with advantage be larger, to give space for a number of players and onlookers. As, however, a cue, when striking a ball at the edge of the table, is held at an angle, it occupies rather less than five feet horizontal space, consequently a room twenty-two feet by seventeen is sufficient; or even a little less. But where the space can be spared it should be longer than twenty-four feet, and have a recess besides. Seats on a raised platform, so as to command the table, are placed for onlookers. The corners of the room, out of the range of the cues, are the best positions.

Sometimes a billiard-table is placed in the hall, where it is convenient for a pastime, and for ladies joining in the game. Its brown-holland cover, when unused, is out of place in what is usually one of the handsomest apartments of the house, but there is no necessity why the cover should not be of some more ornamental stuff. To regular players, however, this arrangement is not satisfactory. It renders smoking impossible, else the house would be filled with tobacco fumes, while the exposure to every caller prevents playing in shirt-sleeves.

SMOKING-ROOM.—Notwithstanding the increasing prevalence of the practice of smoking we have not yet, as on the Continent, made it free of every room in the house.

Even were it not opposed to our notions of cleanliness, the dampness of our climate, which retains the smell of stale tobacco more readily than a dry one, necessitates the appropriation of a special room to the purpose, unless we inflict considerable discomfort on one large class of visitors by sending them to smoke outside, or on others by the odour of smoke inside. The billiard-room often serves the purpose, in which case it should have a window recess with a writing-table; sometimes the library is used, not without inconvenience; for the library may be wanted for those who dislike smoking, and books are apt to retain the smell of stale tobacco. A smoking-room is often placed in a top story, and sometimes in an isolated tower, to prevent the pollution of the house. As the practice is by many considered improper, any room is thought good enough for a smoking-room.

There is a tendency, however, to give the room more importance; sometimes it is elaborately decorated, and becomes, rather than the library, the gentleman's retiring-room. In most cases any position will do for it. Beside the bachelors' bedrooms is not inconvenient. It should have convenient access to a lavatory and water-closet.

Such are the principal day-rooms which modern habits require. In every house all may not be necessary, in some their number may be increased by defining more specially the purpose of each. Old houses used to have separate winter and summer parlours and dining-rooms with warmer or cooler exposures; a special music-room sometimes forms part of a drawing-room suite; and great houses may have state apartments in addition to those for family use, such as a ballroom or concert-room, a state dining-room and drawing-room, picture or statue galleries. It would be beyond the limits of this chapter, which professes to deal only with houses of moderate extent, to treat fully of all

these. Where special galleries for pictures and sculpture are necessary, it will mitigate the cheerless character of the usual ceiling-light—and if properly managed it need not spoil the lighting—to provide some window in them where we can see out at; but it is better in most cases to use works of art for adorning the rooms we live in. In planning a house, the architect is bound to provide positions with proper light for pictures and sculpture. Often this is not thought of, sculptors sometimes finding, on taking a bust home, that there is not a good light in the house to place it in. The chief point is to have the light high enough, without cross lights; and for busts or other pieces of sculpture, to provide positions with good light, where they will be out of the way of the traffic.

The place of great reception-rooms might in many cases be supplied by a HALL of the old type, which would have even greater dignity, without their dismal character when out of use.

Such a hall forms a charming feature even in a moderately-sized country house. It is much better than a drawing-room for dancing and games; for the oak floor may be left exposed, with merely loose rugs opposite couches and fireplace, and instead of the quantities of fragile furniture and ornaments with which a drawing-room is usually encumbered, a few oak benches and tables are all that is required.

It may be merely a large room off which the other day-rooms enter, or it may have the staircase as part of it; and may include two stories in its height, with a gallery round it for access to the upper rooms, giving any amount of scope for architectural magnificence.

When there is such a hall, the drawing-room need not have the width which is necessary when it is used for dancing, and may be arranged solely for the purposes of

conversation and reception, and for the display of precious works of art.

No absolute rule can be laid down as to the number of dayrooms which any house should have, or the purposes to which they should be applied, as, whenever we depart from the orthodox number of three, the requirements vary among families even of the same rank and style of living. Some men, for instance, cannot live happily without their own special room to retire to; others never feel the want of it. Some have rooms, as they have dresses, for gala days—too grand for ordinary life, too large to be comfortable, or too delicate in their decorations and furniture for the wear and tear of daily use. Others will have no rooms which are not constantly occupied, the decoration and furniture being of such a character that they will not be injured by constant use, rooms large enough for entertainment and not too large to live in. It is a good rule, when the rooms generally are of moderate size, to make at least some one room in the house large enough for receiving company. In country houses I would make the Hall such a room: in town it should be the drawing-room, which for daily use might be divided by folding doors and curtains, so as to be thrown into one when necessary. Such diversity of requirements constitutes a difficulty to the architect, as, since the house will outlast the lives of those for whom it is first built, he is bound to plan it not only to suit them, but those who will follow them. It is a wholesome check on the indulgence of individual peculiarities, which seldom realise the expectations of their designers, for a man when building for himself to make his house such, that if sold he would get back his money for it.

Bedrooms.—For planning a bedroom the rules are few and simple.

A position should be provided for the bed, out of the way of the draughts between window, door, and fireplace; not with the object of excluding air, but rather that it may be admitted without danger of cold to the sleeper. This is more easily managed, especially in small rooms, if our notions of symmetry will permit us to place the window as well as the door, not in the centre of the room, but in the centre of that part of it left unoccupied by the bed (fig. 149). In this case the bed may occupy either of the positions dotted; and the door may be at D or C. D is the worse position, as when opened it exposes either the bed or the fireplace.

There is an advantage in having two windows in bedrooms, especially in those for visitors, which are to some extent sitting-rooms also, as while one is blocked up by the dressing-table, the other is free for sitting at. If the windows are together, the dressing-table may be placed between them, avoiding the ugly appearance which the back of the looking-glass has when seen from the outside.

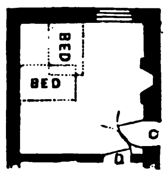


Fig. 149.

The foot of the bed should not face the window, especially if it has an eastern aspect, otherwise, unless the light is blocked out, we are wakened unpleasantly at sunrise by the sun shining from the feet as if into the brain. This inconvenience was not felt in the last generation, when four-post beds were in fashion, as in these the curtains could be drawn across the foot of the bed. Proper positions must be provided not only for the bed, but for the other furniture, including wardrobe, washstand, dressing-table; and in some rooms, sofa, easy-chair, and writing-table. The more windows there are in a room, the more difficult is it to accomplish all this. One of the most frequent mistakes of modern planning is ex-

cess of window light. This not only loses valuable wall space but it makes the house a worse shelter against the weather; colder in winter and hotter in summer. We might almost as well live in a glass house as in some modern rooms. If the window lighting which is given be exactly in the right place, the room may be perfectly lit with a comparatively small amount of glass.

As merits are made apparent by their contraries, fig. 150 may be instructive, as showing what the planning of a bedroom should *not* be. In this case the door opens either on the bed or on the fireplace, beside which there is no comfortable seat, the bed faces the light, there is no space for a wardrobe, and if we put the door in the

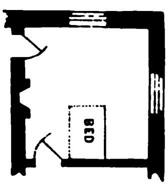


Fig. 150.

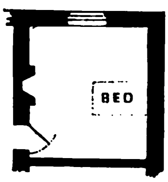


Fig. 151.

centre of the wall, we render the room absolutely useless as a bedroom. To plan so badly, however, would require perversity of ingenuity, for the fault can be remedied at once by simply removing one of the windows. If in addition the door is placed in the same wall as the fireplace, the arrangement is unexceptionable, as in fig. 151.

It is convenient, especially for visitors' rooms, to arrange a suite, consisting of bedroom, dressing-room, bathroom, &c., so as all to enter off a private passage (fig. 152). For lighting this passage, however, we must often have recourse to borrowed or roof-light. Such an arrangement is especially necessary to give retirement from the noises and

traffic of the house, where the rooms enter, as is sometimes the case, off a gallery round a great hall.

It is convenient to place less important bedrooms in sets, so that one group may be appropriated to bachelors, a separate group to young ladies, giving facilities for those long talks at night in each other's rooms, when, with their back hair down—if we take Mr Thackeray's word for it—they open their hearts to each other in mutual confidences.

For a Dressing-Room to have access only through the bedroom is a fault of planning which deprives it of a great part of its value, the servant being unable to enter it, or the gentleman to leave it, without passing through the lady's bedroom. Even more inconvenient is an arrangement I lately saw in a new house, of making the only entrance to the lady's boudoir through her bedroom. A dressing-room may serve its purpose even if very small, but there should at least be room in it for a wardrobe, besides washstand, dressing-table, and a chair or two. Space for a small bed also is often useful. Sometimes a bedroom has two dressing-rooms in connection with it.

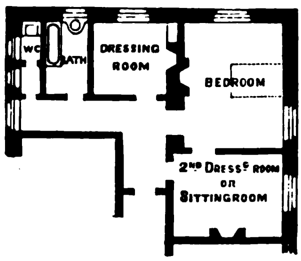


Fig. 152.

In visitors' apartments, the dressing-room, if large enough, and especially if a washing-room or bathroom is attached, may serve as a private sitting-room; or the master's, as already remarked, may be also his study, thereby saving the necessity of an additional fire.

Providing suitable positions for the furniture depends more on proper planning of the space at our disposal than on its extent. Still, to be niggardly of space is often false

economy, as the expense of a house depends quite as much on the number of its parts as on their size.

NURSERIES.—It is well even in a bachelor's house to give some of the rooms the arrangements proper to nurseries, as it will render them not less useful as bedrooms, and at some time during the existence of the house they will probably be wanted for their proper purpose.

A complete nursery suite includes a day-nursery, one or two night nurseries, with space for a bed for the nurse and cribs for the children, a scullery and water-closet; with sometimes a bathroom, a bedroom for older children, and a small room for an under-nurse, who, however, generally finds accommodation with the other servants, a bell from the nursery being provided for calling her when wanted. A press for crockery should be provided, and ample closets or wardrobes for the children's clothing. When a scullery and water-closet are provided for the use of the nursery department, to avoid any risk from the drains, it is better that these, or at least the water-closet, should not be within the door which closes in the nursery suite. When there are two nurses, this separation is no inconvenience. When there is only one, it is well that the nurse should be able to do her work in the scullery, while still looking after the children. The connection of a scullery with the drains may be so broken as to avoid all danger of sewer gas rising through the sink.

The nursery department should be shut off from the rest of the house; for however interesting children may be, there are times when our appreciation of them is increased by their absence. For their own sakes it is well they should be able to make what noise they like without disturbing others. It should all be on one level, access to steps or stairs being dangerous for young children, and increasing immensely the trouble of looking after them.

Its position should be near the mistress's bedroom, for no superiority in nurses can supply a mother's oversight: it should have access to the garden, apart from the main corridor and stairs, so that there may be freedom for running out and in without these being dirtied by the mud and gravel which children, notwithstanding all injunctions to scrape their feet, inevitably bring in with them. On the principal floor, if sufficiently raised above the ground to be wholesome for sleeping-rooms, would be the best position for nurseries; but there are generally too many claimants for its space to allow of this. To put the day-nursery alone on the ground-floor, as Mr. Kerr suggests, would scarcely work; for the nurse would frequently have to leave her charge, which would be dangerous with enterprising children. The night-nursery, and the scullery also, should open out of it, so that while doing her work the nurse can be always near the children.

Where there is a family suite, the nurseries are put over it, a private stair connecting them, and leading also to the garden. Usually they will be placed between the mistress's bedroom and servants' stair (see plan, p. 135), shut off from it, however, by a door, to prevent babies tumbling down, and that they may not be in too close communication with the kitchen.

It is a great advantage when nurseries have attached to them a roomy well-lit lobby or passage for the children to run out into, giving them change, and avoiding the tiresomeness of confinement to one room.

The day-nursery can scarcely be too large. It is a sort of common hall where children and nurses live and take their meals together, and where the children (though they do not sleep) are washed and dressed beside the fire. The nurse may see a friend at times; and female visitors of a certain class, such as old family dependants, who could neither be sent down among the servants nor received in

the drawing-room, can here feel at their ease, and meet the members of the family on common ground. It should therefore be large; and it should also be light, airy, and cheerful; and it is most important that it should have a sunny exposure. A view of scenery is of little importance; children will find a farmyard, where they can see cocks and hens and pigeons, or even the rubbing down of the horses, much more interesting.

The nursery scullery is used for cleaning the dishes from the nursery meals, for drawing and pouring away water, &c. It need not be very large; but it is convenient if it have a fireplace, for it is a comfort in hot summer weather to be able to remove from the day-nursery the perpetual fire needed for warming babies' pap and other purposes. Where the house is supplied with gas, a small gas apparatus in the nursery grate for boiling a kettle or pan serves this purpose. I have had such grates made with a small oven on the other side for keeping food hot should it be sent up too soon from the kitchen.

The nursery fire must have a boiler for providing hot water for the children's baths, &c., unless this is supplied to the scullery by pipes from the kitchen, in which case it is sometimes supplied also to a little fixed bath in the room, just large enough for children, with lid to shut it in when not in use. In this case the plumber's work must be good, and care must be taken to break the connection of the waste-pipe with the drains.

If there is no nursery scullery, there should at least be provision for drawing and pouring away water on the same floor—in a housemaid's closet, or even at a sink in the water-closet. In many cases the sink and water-closet common to the floor serve without much inconvenience for the nurseries. Great additional labour is caused if water has to be carried from another floor, and for the same reason a coal-store should be provided near. A supply of

hot water to the nurseries is of advantage, besides saving labour, for it is often a fruitful source of quarrel if hot water has to be taken from a kitchen boiler which is filled by hand, as accusations by the servants against one another of drawing off the hot water without filling the boiler again are inevitable. Wherever it is possible, the nursery should be made independent of the servants' department, and isolated from the dayrooms and bedrooms.

School-room.—The school-room, besides its proper use, is the living-room for the children who have outgrown the nursery, and the sitting-room of the governess when her duties are over. In most houses the only meal for which it is used is the children's tea, as they dine, according to their age, either in the nursery or at the family lunch.

Great size is not necessary for a school-room—about fifteen feet square may suffice, though for children space is never amiss; but in this, as in all children's rooms, there should be abundant light. It should have easy access to the garden—for an occasional run out will relieve the irksomeness of confinement and lessons, especially to younger children—and on this account would be most conveniently situated on the ground-floor; but the stronger claims of other rooms for the ground-floor space will in most cases send it upstairs, and it is convenient for many reasons to place it beside the bedrooms of the governess and her charges. It should be shut off, so that the other parts of the house shall not be disturbed by the perpetual practising of scales on the school-room piano. It should have a water-closet near, and a wash-hand-basin in it or in its neighbourhood is convenient. A complete bedroom suite has all the requirements necessary for a school-room suite, and may be appropriated to this purpose, the dressing-room being the governess's bedroom.

BATHROOMS, LAVATORIES, AND WATER-CLOSETS.—In every house which pretends to convenience and perfection in planning, there must be several water-closets—in no case fewer than three—for the male and female portions of the family, and for the servants.

The most convenient situation for that for gentlemen is within a small room near the entrance on the ground-floor, which serves as cloakroom, bootroom, and lavatory; and for these purposes is provided with pegs and presses for hats and great-coats, and conveniences for holding boots and slippers, and a wash-hand-basin supplied with hot and cold water.

There must be a water-closet among the bedrooms for the female portion of the family, which in smaller houses may serve for the nursery also.

That for the servants is more conveniently placed down-stairs than beside their bedroooms, but large houses may have one in both situations, and they should have separate ones for male and female servants.

Some people look on every additional water-closet as an additional source of fever from sewer gas, and would not only reduce their number, but banish them from the inside of the house. The tendency of modern planning has been to increase their number, scattering them all over the house instead of placing a less number in convenient situations. That for the nursery may serve also for the school-room, and unless the house is very large, for the bedrooms on the same floor. That provided off the cloak-room should be convenient to the billiard-room and smoking-room. But each separate set of bedrooms should have its own; and the arrangement of enclosing a bedroom, dressing-room, and bathroom, within one door is not complete unless a water-closet is added. But in this case the vestibule, off which the rooms enter, and the water-closet should have windows opening directly to the air (see fig. 152, page 69). They

should not be too small, as they usually are, but should rather, where possible, be pleasant little rooms. Each should have a window direct to the open air. Wall-light is preferable to roof-light; but even when in the centre of the house, and with a story over them, lighting and ventilation may be managed by a shaft carried through the story above them; and even when in the same position in a lower story, ventilation is practicable by means of a ventilating pipe or flue, with gas burning at the bottom so as to make it an extractor, provision being also made for the admission of fresh air. Such an arrangement is, at best, a make-shift.

Bathrooms.—For ordinary houses, a single bathroom is sufficient. In larger houses it is convenient to have one on each floor of bedrooms; there may be a small bath for washing children in the nursery, in some corner out of draughts and near the fire. There should be a bath in each bedroom suite, either in the dressing-room, or in a separate bathroom. Each set of young ladies' or bachelors' bedrooms should have a bath-room attached. I think the servants should have the use of a bath, but they will not use it unless it has hot water. In some houses a bathroom is provided for each guest, so that on returning from shooting to dress for dinner each man can have his bath at once.

Such a number of bathrooms may seem extravagant luxury, but arrangements of this kind save servants' labour, which is yearly becoming scarcer. The number of baths in a house will be limited by the quantity of hot water which the kitchen boiler can supply, unless we are content with a supply of cold, which is comparatively useless, or have special means of heating for extra baths, such as a number of gas-jets under them using the bath itself as a kettle, or a boiler heated by a fire in the bathroom.

A bathroom should not be very small, else it fills with steam from the hot water. It should not, if possible, when

intended for general use, be the same apartment as the water-closet, but in some cases it must be so to avoid the greater evil of want of proper ventilation, in situations where each cannot have its own window, or when the space is too small to keep them separate. In a bedroom suite the bathroom and water-closet may be united without much harm, or the bath may be in the dressing-room.

The best material for baths is copper "enamelled" on the inside, that is covered with hard paint, as such baths, being thin, do not lower the temperature of the hot water as a marble bath does. They should be made narrower at the bottom, and rounded, so as to require less water to fill them, which is of importance when there are many baths in a house and other demands on the supply of hot water. Baths made of slabs of marble must be square at the bottom, and must have a lead tray under them to catch the water which leaks from the joints. A bath hollowed out of a single block of marble, like the old Roman ones, can be had without exorbitant expense. Nothing is better for a cold bath, but it is liable to the objection that it cools the temperature of hot water, and there is the same objection to baths made of earthenware. Zinc makes a good bath, and thin cast iron enamelled on the inside is also used. Wood painted inside, with a lead tray under to carry off leakage, is cheap and efficient, as it does not draw the heat out of the water. Wood lined with lead was formerly used, but it is cold and unpleasant looking, and gets slippery.

Besides the LAVATORY at the main entrance, which serves also as a cloakroom, there may be one beside the billiard-room, and perhaps another beside the garden entrance.

In some houses fixed basins, with hot and cold water, are provided in dressing-rooms, and even in bedrooms. This is

certainly a saving of labour, but only to a small extent when provision is made on every floor for drawing hot and cold water and pouring away slops. If such basins or baths are fixed in sleeping-rooms they must on no account be connected with the drains, but must discharge into the open air so as to make it impossible for sewer gas to get into the room.

Extensive and elaborate plumber-work adds considerably to the cost of a house, and it may be taken as a general rule that unless we can have it perfect the less we have of it the better. This subject will be more fully treated in a later chapter.

CHAPTER IV.

THE SERVANTS' OFFICES.

"IT is," says Mr. Kerr,[1] "the foremost of all maxims, that however small the establishment, the servants' department shall be separated from the main house, so that what passes on either side of the boundary shall be both invisible and inaudible on the other."

"The outdoor work of the domestics must not be visible from the house or grounds, or the windows of their offices overlooked." "The sleeping-rooms of the domestics also have to be separated both internally and externally from those of the family, and indeed separately approached." "The idea which underlies all is simply this: The family constitute one community; the servants another. Whatever may be their mutual regard and confidence, as dwellers under the same roof, each class is entitled to shut its door upon the other, and be alone."[2]

Is not this carrying the separation a little too far? The days are gone when the whole household could dine at one

[1] The Gentleman's House, p. 67. [2] Ibid., p. 68.

table; but should the mistress not have the run of her own house? Should the master not know his own servants when he meets them?

This treatment of servants as an inferior class, whom it is shocking to the refined feelings of their superiors to see or to come in contact with; who have no interests in common with the master; who are paid to do their work, and perhaps do it, but no more, helps to produce the want of interest in their work, the love of dress, and the frequent changing of their places, of which mistresses nowadays complain so loudly. Those who complain of modern degeneracy forget that formerly there was a friendliness and familiarity between servants and their master and mistress which modern customs would not tolerate for an hour. Why should they stay years in their places? There is no pretence of affection for the family, who might possibly resent any expression of it. Why should they do a jot more than their strictly bargained share of work? They are not paid for it. Need we wonder that they are so often of the class described as "unprofitable servants"? "They have done that which it is their duty to do."

I venture to doubt if a house should be planned as Mr. Kerr recommends, so that the servants may shut themselves off from the family in a separate establishment, where the mistress feels herself an intruder. She is responsible for their conduct, and should be able to encounter them at their work, and as they go to their rooms, without having to go prying after them. Some good housewives, therefore, like their store-room among the servants' offices, and object to the servants' bedrooms being isolated from the house. There is no such objection to complete separation of servants and family in large houses where there is a housekeeper, who acts as their mistress, and lives among them.

In a large house, the apartments for the men-servants

under the control of the butler should be separated from those of the female domestics, with the servants' hall, which is common to both, between them.

Under no circumstance, of course, should the servants overlook the private life of the family, while they in their servants' hall and apartments are entitled to live unobserved by the family. None of their windows should command the lawn or private garden; and they should be able to go about their work without passing through the main stairs and corridors. Household work is not a thing to be ashamed of or hidden out of sight; it has been a favourite subject with many painters, but a sense of fitness will keep it to its proper place.

In arranging servants' offices the guiding principle is that each servant has his or her own place to work in, without interference from the others.

In a small house where a single maid-of-all-work is kept, the kitchen may serve not only for cooking, but as butler's pantry, and perhaps also as laundry. It is more convenient for her to work in one place, for she may keep an eye on her cooking as she cleans the knives or irons clothes. But if there is a "parlour-maid" also, difficulties and disputes will probably arise, unless she has her own pantry to work in, even if there is room for her work in the kitchen.

If each servant has her own place to work in, it is of less importance that she should have separate apartments for her different kinds of work. The enormous development of the servants' offices characteristic of modern planning is not without its disadvantages. All these places, with the interminable passages connecting them, have to be kept in order; and, if they increase the facility of doing the work, they increase labour of the house, and necessitate a greater number of servants.

Whatever the size of the house, the servants' offices may be divided, according to the services of cooking, waiting, and keeping the house in order, into the departments of kitchen, pantry, and housemaid's closets, for cook, butler, and housemaid.

In large establishments the number of servants in each department will be multiplied; accommodation for valets and ladies'-maids may have to be provided; and most country, and some town houses have a laundry. In such cases the departments of male and female servants should be kept distinct; the butler being at the head of the one, the housekeeper of the other.

We shall not follow Mr. Kerr in his division into upper and lower servants' offices, not only because the number of houses is limited in which provision has to be made for a steward, head cook, butler and valet; housekeeper, head ladies'-maid, and head nurse,[1] but because the division is false; the offices for these head servants being in most cases the same as for those under them.

Besides the servants' offices, where they do their work, the servants' department includes their living-rooms, such as the servants' hall and bedrooms. In some small houses the departments may be merged; the kitchen may be used as servants' hall. In town houses the pantry often serves also as the butler's bedroom.

One of the chief difficulties of planning consists in adapting the size and extent of the offices to the size of the house, and to the requirements and habits, not only of the family for whom it is built, but of others who may succeed them.

The KITCHEN DEPARTMENT consists of the kitchen itself for cooking, the scullery for cleaning pots and dishes, larders for keeping meat, presses, and store-places.

[1] 'The Gentleman's House,' p. 229.

In architectural magnificence kitchen-building has not advanced since the Middle Ages. The kitchens of Glastonbury, Fontevrault, and Durham—all abbey kitchens—are magnificent vaulted octagons. The last (still used as the dean's kitchen[1]), and those of the great colleges, are found perfectly adapted to the refinements of modern cooking. It is questionable, indeed, whether the cooking art has advanced since the days of the Romans, or even of the monks. In the tenth century St. Bernard charged the Monastery of Cluny with over-zeal and skill in cooking. On fast-days their preparations of eggs and fish were so cunning as to taste like flesh. If the *differentia* of man is that he is the cooking animal, kitchens, as exponents of his superiority to the lower animals, and sacred temples of humanity, may be fit objects of architectural grandeur; except that, however much we are indebted to them, we could scarcely have veneration for their high priests; though in truth the use of old temples, including that at Jerusalem, was to a large extent as kitchens. Food for the multitude was prepared in them: the priests acted as cooks and butchers.

For health and comfort the kitchen is perhaps the most important apartment in the house, and when the house is magnificent, is capable and worthy of architectural grandeur; but the essential thing is that it be cool and clean, well ventilated and well lit.

The first requisite is good ventilation, not only because a close atmosphere is oppressive to the cook and injurious to good cooking, but because, unless the kitchen itself is ventilated so that all smells and vapours pass immediately away, they are sure to get into the house, greeting us with their sickly odour in the halls and passages, and finding their way

[1] It is said that the late Bishop of Exeter, on being shown this kitchen, remarked to the Dean what a magnificent oratory it would make. "My lord," was the reply, "so long as I am Dean this kitchen shall never be desecrated."

to the topmost bedroom, notwithstanding all contrivances of swing doors and crooked passages.

In some large houses and hotels, and even in clubs, where one would have thought the architect might have prevented it, the atmosphere has an accumulated taint of perpetual cooking. On this account it is better that a kitchen should have no room over it, so that it may ventilate directly from its ceiling into the open air, though in this case the smells from it often draught into the house at open windows; but even in a kitchen in a sunk story, with rooms piled over it, perfect ventilation is possible (see chapter on House-Ventilation), and it is especially requisite if, instead of the old open fire with its wide chimney carrying up the vapours of the cooking along with the smoke, there is a "close range," a sort of heated iron table on which, instead of on the coals, the pots are placed, so that the vapours from them do not go up the chimney, but into the room. The close range has the advantage in cleanliness, economy of fuel if well managed, and greater cooking power; but when it is used, unless the kitchen has special ventilation independently of the chimney, we know on entering the house exactly what the family are going to have for dinner. An opening into the chimney over the close range may give some ventilation, and mitigate the smell.

In *position* the kitchen should be near the dining-room, to save labour in carrying the viands, and to avoid their being cooled in their passage through long corridors; but its windows and ventilators should not be near those of any family living-room, and its chimney should be carried to the highest part of the house, else the smells may be wafted in by open windows.

If on a different floor from the dining-room, there should be a "lift" to save the labour and danger of breakages from carrying the dishes up and down stairs; which, however,

should not open into the kitchen itself, but into some room or passage near it, else it becomes a shaft for bringing kitchen vapours into the house. Neither should the lift open into the dining-room (as Mr. Kerr suggests), not only on account of the risk of smells, but because it would act as an open shaft to allow the conversation of the dining-room to be heard down stairs; but into some well-ventilated service-room or passage near it.

To prevent cooking smells entering the house, the kitchen is sometimes placed beyond the back entrance so that we have to pass through the open air to enter it from the house, or it is even made a detached building communicating with the house by an open covered passage, which may be effectual for the purpose, but is inconvenient. For the same reason it is sometimes placed in the top story, communicating with the dining-room by a lift; but even this will not prevent the smells entering the house, if there is a draught downwards, as often happens. It is also inconvenient, unless there is a clerk of the kitchen, with an office near the ground-level, to receive the kitchen supplies, for all the tradespeople must climb to the top story, or the cook descend to attend to them.

The best position, on the whole, for convenience and avoiding smell, is on the ground-level, or, where space is valuable, in a sunk or partially sunk floor; near the dining-room, but removed from communication with the rest of the house, and especially from any stairs to bedrooms. A kitchen on a sunk floor with the principal rooms of the house over it may be perfectly ventilated and all risk avoided of the smells coming into the house.

The *size* of the kitchen will be determined by the amount of work to be done, the quantity and variety of cooking apparatus to be accommodated, and the number of cooks employed in it. To make it larger than necessary will be found an inconvenience; in most houses a space of thirty

feet by eighteen is ample for the most extensive cooking apparatus. For ordinary houses, where there is a single cook, it should scarcely be less than an area of eighteen feet by twenty, although the experience of French houses, where elaborate dinners are produced in kitchens no bigger than a small omnibus, shows that size is not essential to good cooking.

This does not prove small kitchens good, or that the cook should be forced as in French houses to the alternatives of being stifled with charcoal fumes, or catching cold from the open windows; but only that a good workman can produce good results with bad tools. In all questions of servants' accommodation, the French, notwithstanding their strong sense of equality, have a great deal to learn.

In smaller establishments, as the kitchen usually serves also as servants' hall, it should not only be of sufficient size for this purpose, but should be so planned as to have a convenient place for the dining-table out of the way of the cooking operations.

The *aspect* should be a cool one, especially in the afternoon, when dinner is preparing. West or north-west is consequently the worst, north-east is the best; but south-west is not objectionable, as the sun's rays have passed off it before the more serious operations commence.

The light should be ample: it is better when it comes from the left side, so that the cook does not stand in her own light when working over the fire; and the window should be placed high, that it may shine into the cooking vessels, for which purpose roof-light (in addition to wall-light) is best.

It is most important that a kitchen be dry, as a damp atmosphere, even when heated, retains and aggravates the cooking smells, giving the air a permanent taint.

For the ceiling and walls probably nothing is better than plain limewash, as it keeps them fresh and is easily

renewed. Up to the height of four or five feet the walls should be lined with some material which can be washed, and will stand knocks and rough usage, such as wood or tiles, or cement.

The floor should be of some hard material from which grease-spots may be removed; such as stone flags, tiles, or cement. Cement, unless of a better quality than is ordinarily procurable, however much it is cleaned, is apt to look dirty; stone flags look cold, red tiles six inches or nine inches square are clean and warm-looking. The larger common tiles such as are used in farm kitchens, I find less apt to get slippery than the smaller finer tiles. In small houses where the kitchen is used as a living-room, a boarded floor feels warmer; but in this case there should be a broad flagged passage on the fireplace side, where the work is done, leading to the scullery. The comfort of the boarded floor is dearly purchased by the presence of cockroaches and black beetles, which, aided by the kitchen heat, it is pretty sure to harbour. To give no harbourage for these or for crickets the utmost care should be taken to have no crevice about the fireplace, where the heat is favourable to their development. Some people like them. I have known people establish a brood of crickets on their hearth. If the proper means are taken to give no harbourage whatever, cockroaches may be completely stamped out (not by crushing, which is ineffectual as well as difficult and disagreeable), even in London under-ground kitchens.

KITCHEN-RANGE.—The extent of cooking apparatus will depend on the amount of cooking to be done. Six feet wide by about three feet deep is a common size—large enough for a roasting-range, with a hot-water boiler behind, and ovens for pastry and bread baking, heated either by the same or a separate fire, with a hot-plate in addition for extra cooking, which may be omitted if a close range is used, as it serves the same purpose. With a close range,

roasting is done in an oven continuously supplied with fresh air, which, if properly constructed and well managed, may do the work as well as an open fire, with the advantage of greater cleanliness and economy of heat, provided we can depend on always having a cook who will take the trouble to manage it; but as it is a furnace which can be made to burn away the coal to any extent, it is not generally found in practice to be economical; and too often the meat is half baked rather than roasted. A close range makes the kitchen much hotter than an open fire, and as the smells do not go up the chimney, an air shaft should be provided to carry them off. New ranges, however, are constantly being invented, which profess to combine every advantage. Some small American cooking stoves which stand free on the floor are capable of doing a great quantity of work with little expenditure of fuel, and are frequently placed now in the great old wide fireplaces of farm kitchens and cottages in the country. Till ordinary cooks are careful and know how to manage a close range, the old open fire is on the whole preferable.

A few gas-jets for boiling pans make a useful addition, and gas may be also used with success for roasting. When used constantly it is more expensive than coal, but when used only occasionally, from the ease with which the heat can be started or turned off, it is convenient and economical.

The cooking apparatus may be increased to any extent, according to the amount and variety of the work. College kitchens have a fire a few inches thick, ten or twelve feet long by about three feet high, for roasting innumerable joints.

Where high art is aimed at, multiplicity and variety of apparatus rather than mere extent of fire is necessary—open fire for roasting, ovens, coppers for boiling, charcoal stoves or bain-maries, but, above all, extent of hot-plate,

giving variety in the intensity of the heat for the different operations.

ADDITIONAL SMOKE-FLUES.—Each fire should have its own smoke-flue, as leading several flues into one may make it smoke unless the draught is good. Even if not wanted at first, it is always prudent to provide one or more additional flues.

A HOT-CLOSET is sometimes added, for keeping dishes hot till they are wanted, but this is more useful if placed in the serving-room beside the dining-room.

BREAD-OVEN.—Modern ranges have sometimes an iron oven heated by a fire underneath for baking bread, which often works satisfactorily, though the brick oven commonly used for the purpose may be preferable. Wood is burnt in it till it is thoroughly heated, after which the ashes are swept out, and the bread put in and baked by the heat of the bricks. Such brick ovens are usually placed in an outhouse, though we sometimes find them in old kitchens, or they may be erected in the scullery. In large establishments there may be a regular bakehouse, with dresser for making the bread, and shelves for drying it, kneading-trough, flour-chest, space for sacks of flour, and a wood-house at hand.

PASTRY-BAKERY.—A small cool place for baking pastry is often provided, with a marble slab at the window for kneading, the heat of a kitchen being injurious to the operation; for which reason it is not advisable, as Mr. Kerr suggests, to have the pastry-oven in it.[1] It can be fired in the kitchen oven. Nor is a separate store-place generally necessary, as pastry can be kept in the dry-larder.

SMOKE-JACK.—A smoke-jack, which is provided in many kitchens, is a piece of machinery for turning the roasting-spit by the action of the draught up the chimney. It readily gets out of order, getting clogged by the smoke, and

[1] 'The Gentleman's House,' p. 218.

requiring cleaning by a skilled workman every few months. in some old houses we find provision for a wind-jack, driven by a small windmill or fans at the top of the house.

These, like the celebrated dog which was trained to turn the spit, or the boy from whom the jack derives its name, may with advantage be superseded by a simple contrivance containing a spring, which is wound up and will go for hours.

KITCHEN FITTINGS.—The remaining fittings of the kitchen consist of one or more dressers, with good light, for preparing the food, with drawers, and perhaps pins for metal dish-covers above, shelving for tin and copper articles, and plate-racks. It is better, however, to provide close cupboards for the family and servants' crockery, to keep it free from dust and fly-marks.

With an open fire there should be a *roasting-screen* to prevent waste of heat and keep the kitchen cool. It is usually fitted up as a plate-warmer. A stone slab or shelf beside the fireplace is useful for setting pots on when taken off the fire. The *kitchen table* has sometimes cupboards under it for keeping stores required in cooking, and a small slab of marble let into the top for operations for which wood is unsuitable.

The use of the SCULLERY or back-kitchen is to remove from the kitchen work which would cause dirt and mess —such as washing pots and plates, and cleaning fish and vegetables—and especially to isolate the sinks and connections with the drains, which might taint the atmosphere. All such outlets, however, to the drains should be disconnected. The water flowing from them should pass through the open air, to a trap in the pavement, to prevent sewer gas entering the house. The scullery must therefore be well ventilated as well as lit, and it should not, as it often is, be a closet behind the kitchen into which its odours draught. The best position for it is between the back-court

and the kitchen, which it should enter on the side next the fireplace, so that things may not have to be carried to it across the kitchen floor.

It should have at least two sinks in a good light, with hot and cold water, one for cleaning vegetables, &c.; the other three or four feet long, large enough to hold two tubs for washing dishes, with a board or table at hand for placing the dishes to be washed, and a plate-rack above for drying them. It should have a dresser or table for the dirtier operations of food-preparing, and shelves for pots, which are better kept here than in the kitchen. The floor should be of stone or tiles or cement, which can be dashed with water, with a drain to the open air to carry off overflow.

A simple open cooking-range is useful for extra work, or as a standby if the kitchen range is out of order, as when in frost the pipes from the boiler get frozen. When the family is absent, the smaller fire is sufficient for the wants of the servants left in the house.

The size of the scullery must vary with the work to be done. There is no advantage in having it larger than will accommodate the sinks and other fittings. The smallest scullery is better than none; and the smallest house, even a labourer's cottage, where the kitchen is the living room, should have some such place for isolating the dirty work.

In some simple old houses, instead of kitchen and scullery, each with its definite use, there are two kitchens, both used for cooking—one, the back-kitchen, for the rougher kinds; the other employed as a sitting-room, and a very pleasant and homely sitting-room it makes.

Larders.—The name is derived from the time when, the system of winter food for cattle not having been invented, they were slaughtered in the autumn, before they began to grow lean, and the meat salted down, or larded—that is, preserved in pots covered with lard—for use during winter.

The larder in old houses was consequently a considerable apartment, large enough to contain the winter supply of meat for the family. It was in most cases the same as the *salsarium*, in which the salt meat was stored, with the stock of salt fish, for the observance of fast-days.

The name is still applied to the store for meat, not now salted or larded, but hung till it is tender enough for use. For this purpose coolness and dryness are essential, and perfect ventilation by a thorough draught. The windows should face north and east, unless they are otherwise protected from the sun, should be filled with wire gauze to let in air and keep out flies, and glazed so that they can be shut in damp weather or in frost. Sometimes the larder is a separate erection with openings to the air all round. For convenience in depositing supplies, and to avoid risk of heat, it is not advisable that the only access to it should be through the kitchen. It is fitted up with shelves, and a stage or bar with hooks for hanging the meat.

Its size and importance will vary in different houses. In the country, at a distance from markets, it may have to contain a week's or a fortnight's supply; while in towns, where the butcher hangs the meat till it is wanted, it may even be dispensed with. A good larder, dry, cool, well ventilated, in which meat will keep for a long time, adds much to the comfort and economy of a house.

In the COLD-MEAT LARDER, cooked meats, milk, and sometimes other stores are kept. This also must be well aired, free from damp, and cool; the openings, besides being filled with wire gauze should have glass windows for keeping out, when necessary, damp and frost. It is fitted round with shelves; which in this, as in the wet larder, are usually of stone or slate, not as is sometimes believed because it is cooler, but as less liable to dirt and decay than wood. It should have space in it for a *refrigerator*.

The floor, in both larders, should be perfectly dry, and of stone, or tile.

The supplies which the cook may receive from time to time of rice and other farinaceous food, currants, butter, &c., may be kept in the cold-meat or dry larder; but it is convenient to provide a press or cupboard, where, as she is responsible for them, she may keep them locked up. In some houses, however, such stores are given out each morning.

A GAME-LARDER is necessary in some houses, as game, if kept beside meat in any quantity till it is high, might taint it. It is best placed outside, where the gamekeeper may deposit the birds without bringing them into the house. Like other larders, it should be dry and cool, with a through draught on two opposite sides or all round. It is fitted up with rows of small hooks on bars for hanging the birds. Game will keep longer and get into better condition if hung alternately by the head and feet. Where the shootings are extensive, and especially if they include a deer forest, the game larders are of proportionate size.

In some houses where large quantities are used, there is a separate FISH-LARDER. It is a better plan, and may sometimes be managed, to keep the fish alive in tanks.

A separate MILK-STORE is sometimes required, but in most cases the cold-meat larder is found sufficient.

In great houses this variety of keeping places may be necessary, but most families manage to live in reasonable comfort without such multiplication of conveniences. The principle determining the number of larders and store-places should be, that, where different kinds of meat and food are kept in sufficient quantity, a separate place may with advantage be provided for each kind; but to multiply such places beyond the requirements of the family is an error, as it increases the labour and number of the servants, by making useless places, which, with the passages leading to them, have to be looked after and kept clean.

BUTLER'S PANTRY.—In the Middle Ages there were two apartments at the lower end of the hall, across the screens, with the passage or stair down to the kitchen between them, called, in the dog Latin in which accounts and inventories were written, the *panetrium* or pantry (from French, *pain*), or sometimes the *dispensarium*, for keeping the bread, butter, cheese, and other eatables, under the care of the pannetier or panter, who received the bread from the baker, arranged it on the hall table, and assayed or tasted it to prove there was no poison in it; and the *botellarium* (French, *boutellerie*), the butlery or buttery, where the drink, chiefly beer, was brought from the cellar for immediate use, under the care of the butler or *celarius*, who also tasted the wine before it was offered to the lord and guests, as did the sewer the dishes he brought from the kitchen. (See fig. 138, p. 24.)

The Sewery was sometimes identical with the pantry, as the accounts of the royal household in the thirteenth century show, in which the daily expenditure is classed under the heads of, 1st, bread wine and beer supplied from the sewery and buttery; and 2nd, provisions from the kitchen.[1] But properly the sewery was the scutellery, or scullery, the place where the dishes were kept, as the sewer, who arranged them on the table,[2] was in old French the *esculier*, *scutellarius*.

In the buttery, as we find from old inventories, were kept the articles for the service of the table. The 'Status Domus de Fynchall,' A.D. 1360, mentions in the *celarium*, apparently the same as the buttery, two tablecloths, two napkins, two double towels (*manutergia duplicata*); also six dish-cloths, one mazer bowl with silver stand, ten spoons.[3]

In the buttery of the Hospital of St. Edmund, at Gateshead, in the county of Durham, in an inventory of the year 1325, are mentioned four worn tablecloths (*mappæ debiles*),

[1] Parker, vol. i. p. 68. [2] Ibid., vol. iii. p. 80.
[3] Ibid., vol. ii. p. 136.

one long hand-towel, three worn napkins, seven silver spoons, of which three are worn and broken, six casks (*sex cadi*), one barrel (*doleum*), one brass salt-cellar, two towels of coarse cloth (*de canabo*) for the young men, and two tables.[1]

In Sir John Falstolfe's cellar, in 1455, there were two pipes of red wine, and "in the bottre there were about a dozen bottles of different kinds—some of leather, some grete and hoge, iiii galon pottis of lether, 1 grete tankard, xiiij candylokys of laton, certayns pecys of napre, with a considerable quantity of silver-plate, consisting of chargers, platters, dishes, pots, salt-selers, and one bason."[2]

In an inventory of the Prior of Durham, 1446, we find a similar list of silver-plate in the *promptuarium*, or place where table necessaries were kept.

Both pantry and buttery were sometimes under the care of the *celarius*, who, says a record of the customs of Evesham Abbey, must know and be able to provide necessaries for the convent—to wit, bread, beer, two kinds of condiment, and any other things usual.[3]

At Finchall Abbey, near Durham, in the fifteenth century, the pantry and buttery had become one, the articles belonging to both—the cups, bowls, vessels, salt-cellars, candle-sticks, tankards, tablecloths, hand-towels, with the bread-chest and bread-knife—being all in one account under the head of *pantaria et botellaria*, and towards the end of the century the buttery and pantry are united in the *promptuarium*.[4]

Nowadays the butler unites in himself the offices of cellarer, panter, and sewer—setting the dishes on the table, and having charge of table necessaries and of the drink. The pantry with us includes the buttery, of which the name has disappeared except in colleges, where it retains

[1] Parker, vol. ii. p. 137.
[2] Ibid., vol. iii. p. 158.
[3] Ibid., vol. ii. p. 138.
[4] Ibid., vol. iii. p. 157.

the character which it had in religious houses, of an office for the distribution of bread and drink.

In modern houses, the use of the butler's pantry is to contain everything necessary for the service of the table (except the plates and dishes for viands from the kitchen), including glass, knives, silver-plate, teacups, cheese-plates, with proper conveniences for cleaning them, and sometimes also bread, cheese, and condiments. For keeping these, and for table-linen for immediate use, it is fitted up with presses and drawers; a safe for silver-plate, usually made fire-proof and fitted with an iron door; dressers or table for working at; a couple of sinks supplied with hot and cold water, or one large enough to hold two small tubs for washing glasses, &c., with a drainer beside it to let them drip till they are dry, to save the breakage fragile glasses are liable to by the bowls being twisted off the stems when they are dried with a cloth. A fireplace should be provided, not only for warming the room, but that the servant may be independent of the kitchen for hot water; and it is useful also to have a small wine cellar or press, where the butler may keep the supply of wine served out to him for immediate use.

In small houses a pantry is sometimes dispensed with, a mere cupboard being provided for the glass and crockery, the silver being carried for safety to the mistress's bedroom; but where there is more than a single maid-of-all-work it should always be provided, the smallest place which will contain the necessary appointments being better than none. Where there are several men-servants, there must be room for them to work in; but in most cases a space of ten to fourteen feet square is sufficient.

It is most important, for rapidity of service and to save the labour of perpetually climbing stairs, that it should be on the same floor as the dining-room, and as near it as possible; not entering directly off it, as is sometimes the

case in small houses, else the privacy of the dining-room as a family room is destroyed by the servant while at work hearing all that is going on, but with a serving-room or passage interposed. For convenience of communication with the rest of the house, the pantry should be near the servants' stairs; and as it is usually the duty of the butler to open the hall door, it should also be near it, if possible on the same level, so that he may not have to climb a stair every time the bell is rung. But this arrangement is almost never found in London houses, the ground-floor being usually too limited. In consequence two servants have to be kept where with better arrangements one might have sufficed.

For the safety of the plate it is usual to place the butler's bedroom beside the pantry, the plate-safe or plate-room sometimes opening into the bedroom, or, better, into a passage between them. When it would occupy too much space to have the butler's bedroom, as well as the pantry, on the dining-room floor, a *plate-room* for cleaning plate, with the safe for keeping it, may be placed beside the butler's bedroom in the basement, leaving the pantry beside the dining-room for keeping and cleaning glass, &c., which runs extra risk of breakage in being carried up and downstairs. The arrangement necessary in most London houses, of making the butler sleep in his pantry is not a desirable one.

SERVICE-ROOM.—Even in unpretentious establishments, to prevent the smell of dinner permeating the house, there should be communication between the kitchen and dining-room apart from the hall and public corridors. Such a passage, provided with a shelf, is also useful for placing the dishes as they come from the kitchen, and when removed again from the dining-room. It avoids the necessity of exposing the dishes in the hall, or as sometimes happens on the lower steps of the stair. In houses where several

servants are employed in waiting, and the dinners consist of a succession of numerous courses, there may be a service-room, twelve or fifteen feet square, appropriated to this purpose, with shelves, and perhaps a table, for setting the dishes on. It is convenient also to fix in it a hot-closet, heated by the general hot-water circulation of the house or by gas, for keeping the dishes which arrive from the kitchen hot till they are wanted, and for warming plates, of which there is by this means a supply always at hand for the service. But in most houses this is an unnecessary luxury.

The service-room should enter directly from the dining-room at the end next the sideboard, the door being so placed that there is no view into it. The pantry may open out of it. It should be near the kitchen, and when this is on a different floor, the lift for sending up dinner will open into it. It should also communicate easily with the servants' stair.

It should be comfortably warm, else there will be cold draughts from it into the dining-room. The hot-closet may secure this sufficiently, but in houses provided with a heating apparatus it should partake of the benefit of it.

Housemaid's Department.

The duty of the housemaid is to sweep and clean the rooms, arrange the bedrooms, and attend to their fires. As her work is throughout the house, there is in many cases no special apartment for her use ; but both on the principle that each servant should have her own place to work in, and from their great convenience, a *housemaid's closet* should be provided in every house with any pretension to good planning. Their use is for drawing water for the bedrooms, and pouring away slops—avoiding the inconvenient practice of using water-closets for this purpose—and for keeping pails, brushes, coal-boxes, &c. The fittings are a sink with

taps for hot and cold water, which, as it is not for working at, should be set near the floor for ease in pouring away, and shelves and presses for brushes and pails. No great size, therefore, is needed; a small closet under a stair is better than none, but it should have, if possible, a window to the open air, even though the connection with the drains may be cut off by making the refuse water from the sinks pass through the air to a grating outside.

To save the labour of carrying water up or down stairs, there should be a housemaid's closet on every floor, near the servants' stair or in some retired corner among the bedrooms, so that slops have not to be carried up or down stairs or along corridors.

A *coal-closet* on every floor, or a chest which will hold a considerable supply in each housemaid's closet, which is filled by the men who bring in the coals, is a great saving of servants' labour, avoiding the necessity of carrying up the daily supply for the bedrooms and upper rooms. Where men-servants are kept it is less necessary. It should enter off the servants' stair, so that the dust rising from filling it should not get about the house. A coal-lift is sometimes provided for the daily supplies, but it is obviously a greater saving to the labour of the house to have a few weeks' supply carried up to each floor at once when the coals are brought in.

Washing-House and Laundry.

Country houses have usually a laundry and washing-house. It is doubtful if there is much economy in it; when the clothes can be sent out the work may be done as cheaply, if we reckon the expense of buildings and fittings and the wages of the laundry-maid, who may be idle when the family is absent. But the work is better done at home and in many cases there is no other way of getting it done.

The WASHING-HOUSE is fitted with fixed square tubs, for washing and steeping the clothes. They are placed at the window for the sake of light, and supplied with hot and cold water, with a shelf formed of open spars beside them, where the clothes are set to drip. There is a boiler for boiling them, and another for supplying hot water, which are sometimes united so that the same fire heats both. These boilers should be made of copper, as iron is apt to spot the clothes with iron-mould. The washing-house should be well ventilated, to carry off the steam from the hot water. The floor should be of stone, or tiles, or cement, and the walls of glazed brick or tiles, or cement, so as not to be injured by damp from the steam with which the washing-house is apt to be filled. For the same reason it is well if the ceiling, as well as the walls, be not of plaster, though the worst that can happen is, that the lime flakes off. A board is provided before the tubs, so that the servant may not have to stand on the stone floor. The wringing-machine, a simple and efficient American contrivance, by which the water is pressed out of the clothes by indiarubber rollers, without the injury to which they used to be subjected by wringing, takes up no space, being fixed to one of the tubs.

The LAUNDRY—the *lavanderie* or washing-place—is used for ironing and dressing the clothes, and where there is no drying closet or loft for the purpose, for drying them in winter and wet weather. In that case it should be high in the ceiling, so that the clothes may be hung up above the head on horses raised by pulleys. It should have a wide table in good light for ironing; a stove for heating the irons, the heat from which serves also to dry the clothes; and space for an oldfashioned box-mangle (which occupies from twelve to sixteen feet when extended), the smaller modern kinds, in which the pressure is

obtained by a spring, not putting the same gloss on the linen.

In some houses the same room is found to serve without any real inconvenience for both washing-house and laundry, the tubs being covered by an ironing-table when the washing is over.

As regards position, the best for the washing-house is beside the drying-green, for convenience in hanging out the clothes, and of gathering them in in case of a sudden shower. The laundry is most conveniently placed inside the house, with the washing-house beside it, but outside, on account of the steam. It is convenient, but not essential, that they should be together, as when the washing is over, the clothes can be removed to the laundry. If the drying-green is at a distance, the washing-house should follow it, the laundry either remaining in the house or forming with the washing-house a complete establishment, the laundry-maid in this case being, possibly, not one of the house servants.

The DRYING-CLOSET is a small chamber supplied by means of a stove with a plentiful and continuous stream of hot air passing off through a ventilator, and carrying with it the moisture from the clothes. The clothes are hung on horses made of wood (which must be free from gum or rosin, which the heat would bring out on the linen), sliding in grooves at top and bottom from the laundry into the hot-chamber. It is an additional convenience to make them slide also into the washing-house, where the wet clothes are put on them and passed through the hot-chamber (where they remain till they are dry) into the laundry, where they are taken off for ironing (fig. 165, p. 134).

This arrangement is complicated and expensive. To close accurately the apertures into which the horses slide, so that the hot-air chamber is kept tight, requires good workmanship. A less complicated and cheaper kind of

drying closet is a simple brick chamber through which a stream of hot air is passed. It is closed by a door and fitted with bars or horses. The complication of sliding horses is avoided, and the chamber is not too hot for the laundress to remain in during the short time occupied in hanging up the wet clothes, or removing them when dry.

Unless the stream of air through the drying-closet is abundant, the clothes will get yellow; and even with the most perfect ventilation, they can never, if dried in darkness, have the purity and freshness which is given by the sun and open air of a bleaching-green.

SERVANTS' HALL AND BEDROOMS.

The servants, when there are about four or five, usually dine in the kitchen, which for this purpose should be made larger than would be necessary merely for cooking; but where the servants are numerous and the cooking important, it is necessary to provide a SERVANTS' HALL of a size proportioned to their number, for their meals and as a sitting-room. It should be plain, but comfortable; with a wood floor partly carpeted, rather than a stone one; furnished with a table for dining at, wooden benches or chairs, and a cupboard or two. A fixed wash-hand-basin near it may be convenient.

It is well to give it a pleasant outlook, but not over the lawn or garden, where the family may be sitting or amusing themselves. On the other hand, its inmates should not be overseen or overheard by the family. It should be close to the kitchen, for convenience in serving meals; not out of the way of supervision by the housekeeper; and near the back entrance, as it is used as a waiting-room. When the men and women servants' apartments are on separate sides of the house, it forms the point of junction between them.

It is scarcely advisable to use it for such purposes as

"ironing at times, or for dishing and serving dinner, with a hot-plate perhaps among its fittings, or for washing up, when a pair of sinks will be provided, and so on;"[1] and even the brushing of clothes is better done elsewhere, servants being entitled to expect a reasonably comfortable sitting-room when their work is over.

SERVANTS' BEDROOMS.—There are few better indications of the general advance of the people in comfort than the improvement in servants' sleeping-rooms. Happily servants nowadays would object to occupy the closets with only borrowed light, the low rooms in the roof, hot in summer and cold in winter, in which fifty years ago they were not unfrequently crowded two in a bed. Servants' bedrooms should be healthy—this they are entitled to as well as their masters; and they should therefore not be placed in the basement, if at all damp—a position objectionable besides, as giving too great facilities of communication with the outside. Excepting for the cook, who prefers usually to sleep near her kitchen, servants' bedrooms are better in the attics, proper precautions being taken to exclude heat and cold. There should be access to them from the servants' stair; but it is not advisable that they should be isolated, as if in a separate house. Where there is a housekeeper, her bedroom will be placed so as to command those of the female servants. They should be well lit, dark corners being apt to be allowed to get dirty. For ventilation the ordinary system of making the windows to open is sufficient. Several small rooms, with two servants in each, are better than a large barrack; and small single beds are preferable to double ones.

LADIES'-MAIDS' ROOMS should be near their mistresses' bedrooms; but the space on the same floor being too valuable, they are usually placed in the attics, with com-

[1] Kerr, p. 232.

munication as direct as possible by the servants' stair. One of these sometimes serves as a SEWING-ROOM, or there is a special room for this purpose near them.

THE MEN-SERVANTS' ROOMS should be in a different part of the house from the women's—in a separate department if there are several, the butler's being beside his pantry.

VISITORS' SERVANTS ROOMS.—Where there are many visitors, accommodation has to be provided for their valets; which is conveniently done in a long room, as lofty as possible, divided by boarding about seven feet high into separate partitions large enough for bed, washstand, &c., like the 'cubicles' in school dormitories, each having a little window when it is practicable.

Deficiency of servants' accommodation is a more frequent error than excess. Whether because they cannot be packed so closely as they used to be, or because families now require a greater number, either from more service being wanted or from servants doing less work, it not unfrequently happens, even in new houses when they come to be occupied, that some of the rooms intended for the family have to be given up to the servants, diminishing by so much the available accommodation of the house.

HOUSEKEEPER'S DEPARTMENT.

In large establishments the superintendence of the house and the retinue of servants is so onerous, that to attend to it herself would leave the lady of the house no time for her social duties. It is therefore put under the management of a housekeeper, an arrangement the more necessary, as when the family is absent the house is left under her charge. Her room should have a position commanding the servants' department, or at least that of the female servants, the men being under the charge of the butler. It should be near the kitchen, the servants' hall, and the back

entrance, that she may know what is going on. As the housekeeper should be a confidential family servant, it is not considered objectionable if her room looks on the lawn.

In complete examples this department consists, 1st, of the HOUSEKEEPER'S ROOM, which serves as her parlour and business-room—and sometimes also as a sitting-room and dining-room for the upper servants—fitted round with cupboards for the stores and linen under her charge. In some cases it serves also as her BEDROOM, though it is better to have a small bedroom off it, or near the bedrooms of the female servants.

Near the housekeeper's room, or even entering off it, with perhaps a store-room between, is the STILL-ROOM—*the distilling-room*, from its use in old houses for distilling essences and cordials—fitted up as a kitchen with range and oven for confectionery, sink, dresser, shelving, and table. With the assistance of the still-room maid tea is usually prepared here, perhaps breakfast also; and the housekeeper makes her jams and preserves.

Some large houses have a *cook-housekeeper* with the advantage of diminishing the number of domestics. In this case, a separate still-room is unnecessary.

STORE-ROOMS, CELLARS, AND CLEANING-PLACES.

The MISTRESS'S STORE-ROOM was an essential feature of old houses, when retail shops were not so universal as now, and stores were laid in only at long intervals. In the country it is still necessary, and even in towns it may may be useful; for though articles got in bulk are often wasted and may spoil by keeping and more judgment may be needed than in buying from hand to mouth, to lay in stores saves time and trouble in sending for each thing as it is wanted, besides the advantage in cost and quality, and in checking accounts; and diminishes, to some extent at

least, the number of tradesmen calling every morning for orders.

The contents of a store-room are pretty much those of a grocer's shop—a chest of tea, a barrel of sugar, canisters of coffee, rice, sago, spices, preserves, condiments, soap, candles, and any articles of house-consumption which will stand keeping.

It should be fitted up with shelves and presses, with room in it for boxes or barrels. It is convenient to make it in two divisions, for separating articles whose odour might spoil others. It should be perfectly dry, with a window for ventilation as well as light; and, as it should be cool, a north or east exposure is best for it.

A room of ten or twelve feet square is large enough for most houses, but a mere closet may sometimes be sufficient. It should be oblong rather than square in shape—a table or dresser in it may be useful.

In position it should be convenient for the mistress, and near the kitchen, to which most of the stores are given out.

For keeping finer sets of china, used only on special occasions, there may be a press in the store-room, or a separate CHINA-CLOSET may be provided, which should be lit, if only by borrowed light. Sometimes the china is kept in a glazed cupboard in the housekeeper's room.

The LINEN-CLOSET, or NAPERY-CLOSET, as it is called in Scotland, from French '*nappe*,' for bed and table linen, may occupy almost any conveniently accessible position, such as near the store-room or housekeeper's room, or near the bedrooms, the greater quanity being used in them, in which case table linen may be kept in a press in the housekeeper's room or service room. A linen closet should have presses with divisions of about two feet or more—the size to which sheets and table-cloths are usually folded, and should

be fitted with shelves, sliding trays, and drawers. A long table or shelf, or a dresser with drawers, is convenient in it for examining the linen. It should, if possible, have a window, and it is essential that it should be dry. It may have the benefit of the heating apparatus if there is one, or be placed beside an internal wall containing flues, or the hot-water pipes may be taken through it. In many cases, a large linen cupboard in a corridor or in the housekeeper's room may serve perfectly, instead of a separate linen-closet.

A Closet for Soiled Linen is useful, placed near the servants' stair. It should have ventilation, if not light, and it may be made large enough for counting the articles when they are sent to the wash.

A Box-room for keeping portmanteaus and boxes near the servants' stair and the luggage-lift, when there is one, is useful and even necessary. A small attic answers the purpose, but it is more convenient when not at the top of the house. It may serve also as a Lumber-room, or this may be placed separately in some attic. For both damp is to be avoided.

A Brushing-place, where clothes may be brushed without the dust going about any room or corridor, is desirable in every house. Boots and shoes also may be brushed in it, or in a small place for the purpose outside, among the offices, where knives may be cleaned, though, with the patent knife-cleaners now used, this is often done in the pantry.

Lamp-room.—Where oil-lamps are used, the smell of the oil in dressing them is often so disagreeable that it should be kept outside the house; for which purpose there may be a small place among the outhouses, next the coal-cellar

perhaps, with a shelf in a window to trim them at, and shelves, or a cupboard with lock, for the oil and lamps.

For a WINE-CELLAR the first condition is that it have a constantly equable temperature. With this view it is usually placed underground in the centre of the house, and vaulted. Light is not essential, but if it can be got without risk of variation of temperature it is an advantage. In a private house it is scarcely advisable that the equableness of the temperature should be dependent on special heating; as if the family are absent, it may be without it when it would be needed. A gas jet is useful in it for light as well as heat.

For storing the wine in bottles the walls are surrounded with bins formed by shelves and upright divisions of paving or thick slate, or of brick divisions and arches, wood being liable to decay. In old days, when the only variety in the wine was the year of the vintage, a cask of port or burgundy being laid down at a time, the bins were made each to hold a pipe. Smaller bins holding only a few dozen, would better suit our modern custom of drinking many different kinds of wine. They may be easily formed out of the ordinary large bins by wooden divisions.

It is well, even though the owner may not require it, to make the wine-cellar large. Size is no inconvenience, and may sometimes be useful, and the space occupied is not usually of much value for any other purpose. It is sometimes convenient to divide the wine-cellar—the outer part for daily use, and the inner for special qualities, or wine laid down to mature; or the outer portion may be made the butler's cellar.

In some cases a cellar for wine in wood may be required, and a receiving and bottling cellar with an entrance for casks.

In every wine-cellar strong doors, sometimes fireproof, and good locks are advisable.

The size of the BEER-CELLAR will depend on the habits of the family. In some houses, space in some cool closet, or in the outer wine-cellar for one or two small casks may be sufficient. Others, where there is a large consumption and the beer is kept for a time before being used, may have accommodation for a number of barrels, with an opening to the court as wide as the length of the barrels, for rolling them in, with separate cellars for the family and servants' beer. Light is desirable but heat is to be avoided. The only fittings are stands for the casks, which may have screw elevators.

The size of the COAL-CELLAR will depend on the quantity used, and on the frequency of supply, the year's consumption being in some cases laid in at a time. It is well to make it large, to avoid the inconvenience of frequent orders, and of the supply running down in frosty weather, when carting is difficult. A ton of coals occupies about forty-five cubic feet, or a space a yard square and five feet high, which is about as high as coals can be conveniently piled.

The cellar should be so arranged that the coals can be tipt into it from the roof, the coal-shoots being placed in the court where the carts can be taken up to them. There is no disadvantage in its being within the walls of the house. The ceiling need not be higher than one can walk upright in. It ought to have light in it; and there should be access to it under cover, so that the servants may not have to go out in the wet to fetch supplies. It should also have drainage, lest water should lie in it. There may be a separate cellar for the kitchen, with direct access from it, though it is perhaps not desirable to remove the slight check which having to fetch the coals may place on excessive consumption. Coal-stores on each floor of the house are convenient.

Where wood fires are used—a luxury in some districts still possible— a WOOD-HOUSE or SHED of some size may be required. The rough logs harbour insects, and the shed should be outside among the outhouses. When only split sticks for kindling coal fires are required, a small place is sufficient, large enough perhaps for holding waste wood for splitting.

The DUST-BIN should be removed from the house, but approachable under cover. It is an error to make it large, or it may remain for months without being emptied.

If the amount of offal from the kitchen is large, it should not be thrown into the dust-bin, but kept separate and removed to the manure-heap.

As nothing melts ice so fast as water, even at 32°, the melting point of ice, the first essential in the construction of an ICE-HOUSE is freedom from damp, and perfect and abundant drainage; and the next, that it should not be affected by the external temperature. It is usually a domed or vaulted cellar underground, having two or three feet of earth over it, with double walls of hard brick, and an air-space between to keep out damp. The best position is on the side of a bank, to the top of which carts can be brought for tumbling in the ice, while it can be entered below on the level by a passage four or five feet long with double doors, the space between which may be packed with straw.

On account of the influence of damp or water in melting ice, there is more certainty of keeping it above ground, in a stack packed with straw, so that no water lies about it.

As ice resists melting in proportion to the lowness of the temperature at which it is frozen, Norwegian ice, now largely imported (commonly called Wenham Lake ice), will keep longer than any frozen in this country; and as

its first cost is little, the expense of storing a quantity in a stack might not be greater in the end, where land carriage is not long, than the building of an ice-house, and annually filling it with indifferent ice.

In some houses a cellar or outhouse may be wanted for potatoes or roots, in which damp and frost must be guarded against.

Where there is an orchard, some attic will be appropriated as a *fruit-store*, dryness being requisite, and care being taken that the smell does not permeate the house. The numberless stories in the roofs of old German houses, to which they are chiefly indebted for their picturesqueness, were largely used as fruit-stores, and sometimes for the merchandise of the owner's shop on the ground-floor of his mansion, with a windlass for hoisting it to each story.

Additional cellars and outhouses besides those enumerated may be wanted in some houses; but while on the one hand there may be disappointment if every convenience is not provided, on the other it is evil to encumber a house and increase its cost by a number of small useless divisions.

Completeness and minute division in the arrangement of the servants' department of a house implies a large number of servants, and these, from various causes, become every year more difficult to procure. In old days when there were no railways, a country girl taken as servant in a great house, had the best chance she could hope for in life. Now the facilities of communication give opportunity to all to move about and better themselves. Numberless employments are now open to young women, in mills and shops and warehouses, and even in counting-houses, and the Post Office gives employment to a large number in telegraph and other offices throughout the country.

This result has been aided by the ideas of independence

which have grown up among the classes from which servants have been drawn. They object to surrender their liberty, to be always at call, to have no time they can be sure of as their own, to have to ask leave to go out, to be under moral and religious supervision, and to be liable to outbreaks of temper from their mistress or master. It is an outward though an unconscious sign of this, that they dress in the same fashion as their mistresses, only in inferior materials. In shops and warehouses they may have harder work and longer hours, less wages, worse food, and worse rooms, but they have some time they can call their own every day.

All this has greatly reduced the supply from which servants used to be drawn, while at the same time the increase of riches and the far greater number of large houses has increased the demand. The natural consequence has been the great rise in servants' wages, which so shocks prudent housewives.

Housewives of the old school complain of a greater evil, that, with the higher wages, the servants are worse. They stand on their rights; do what they have bargained for, but no more; do nothing to help others who are busy; "unprofitable servants, they do that which it is their duty to do." We constantly hear complaints that the old relations of servants to their masters are gone, that they are constantly changing their places, and never become part of the family, or remain in it all their lives. But it is forgotten that this old practice has another side; under it the servant had claims which modern mistresses would not put up with. If they became part of the family and stayed for life, it was with the certainty of not being turned off when they were past work and useless. If they were devoted they were also familiar, as the old stories show. "James," said a master whom I knew, angry with an old servant with good cause, "I can't keep you any longer, I've no more need of you." "But I've need of you, sir," was the reply which made

farther proceedings impossible. Those servants therefore perhaps act wisely, who make a point of changing their place every three years or so, lest they should get so habituated to the habits and ways of one family as to unfit them for serving others.

Familiarity was possible without "breeding contempt," when the distinction of classes was more clearly drawn. There was a veneration for the upper classes, which was repaid by condescension and kindness. Nowadays the mistress sometimes feels that her only chance of holding her own is to envelop herself in reserve.

The difficulty with servants falls hardest on people with small incomes. The rich can still get servants, each strictly confined to one department, but those who want a single servant, or a girl to help, can hardly get them now, chiefly from the spirit of independence, which makes them prefer some of the other careers open to them. This reduces the supply of servants, for such humble places were apprenticeships, from which the servants advanced to better. The attempt to teach service in Board Schools will not remedy this, as it does not affect the cause, but the teaching may make girls more sensible and capable of seeing that in honest service there is no degradation.

This process has been going on for some time and has materially affected the planning of houses. In no respect have plans been more altered than in providing greater comfort and convenience in the servants' departments, and in contrivances to lessen their labour. The labour of drawing water from a well and the wretched accommodation servants had to put up with would be impossible now.

The number of servants and the responsibility they cause becomes a burden in great houses, to avoid which, it is said that one nobleman made a contract with his cook to supply him with dinner at so much a head, living in his own house as in a hotel.

Should this process continue it may alter our system of living, and our whole domestic arrangements, as it has done in America, and consequently our system of planning. But it will be some time probably before either "lady helps" or co-operative housekeeping become English institutions.

We are well off as yet; sensible mistresses can get good servants. If Dean Swift is to be believed, they are better now than in his day.

CHAPTER V.

THOROUGHFARES AND CONNECTIONS BETWEEN THE ROOMS PASSAGES AND STAIRS.

HAVING described the various rooms and conveniences of a modern house, their uses, and their position with reference to each other, we have now to consider how they have to be united, so as to secure the conditions of modern planning already stated in Chapter II., of isolation of the different parts with convenient position for each, and unity of the whole, without wasting room in passages which do not increase the accommodation, with light and air everywhere, and proper aspect and view for all the rooms, not forgetting architectural effect both external and internal.

This combination of isolation of the several rooms with unity in the whole house is a necessity of modern planning which did not exist in former times, when the advantage of being alone was little appreciated, and when it was thought no hardship to have to pass through the open air in going from one room to another.

The palaces of the fifteenth and sixteenth centuries, consisting of a long range of rooms, to each of which the

only entrance was from the one next it, have unity without isolation, and were suitable only for accommodating a crowd of retainers, who had to be passed before the presence-chamber of the lord was reached; and in French houses, even at the present day, the entrance to the bedrooms is frequently through the *salle à manger* or *salon*. Old English houses, in which each room or set of rooms opened only into an uncovered court, had isolation without unity.

The simplest mode of connecting and at the same time isolating the rooms is by a passage or corridor running

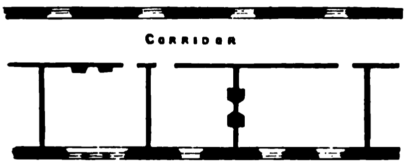


Fig. 153. PLAN SHOWING ROOMS ENTERING FROM A CORRIDOR LIGHTED ON ONE SIDE.

along them, into which each enters (fig. 153), and which, when wide enough to form a GALLERY lit along one side, makes a charming feature in a house. It gives an air of freedom and cheerfulness, makes an admirable promenade in wet weather, and is consequently generally adopted as the basis of the plan of lunatic asylums, in which these characteristics are of great importance. But such a gallery adds to the expense of a house without increasing the accommodation, for we cannot, because a house possesses it, dispense with any of the usual rooms.

It may have pleasant seats sometimes in the recesses of the windows, and it may give additional space for receptions, but it is too narrow for dancing in; and when we settle to read or work, we prefer to be in a room where we can shut the door, uninterrupted by the traffic of the house: nor is it very suitable for a picture gallery, as the wall space being opposite the windows has neither side nor top light.

When, however, expense is no object, there are few more charming features than those galleries, such as we find in old Elizabethan houses.

A more economical arrangement is to make such a corridor serve rooms on both sides of it, and to light it from the end, as in the long passages of modern hotels. Though serviceable, it is not beautiful; we see objects in it against the light and can avoid collisions, but it looks like a railway tunnel. This arrangement is more suitable in a dwelling-house, where the corridor being shorter may be sufficiently lighted by the window at the end. For secondary passages, where convenience only is looked for, it is excellent.

In some cases such a corridor may be lit along the sides by borrowed lights from the rooms on each side of it, at the expense, however, of destroying the sense of enclosure and comfort in the rooms; or from the ceiling, even when it has other corridors over it, by the light coming down from the roof through apertures in the floors of the upper ones, as in the Louvre Hotel at Paris, where, on the principal floor the light is reflected along the corridors by mirrors placed at an angle under these openings; but such expedients have the character of make-shifts, and are destructive of architectural dignity.

The lighting of such a corridor may be more legitimately improved by breaking the range of rooms on one side of it by staircases, the windows of which will give intervals of light along it (fig. 154), or the range of rooms on one side may not be continuous, leaving intervals along the side where the corridor may have windows. This latter addition to the corridor is obviously a waste of space. But perfect lighting in stairs and corridors is worth some sacrifice.

For lighting closets and secondary passages, courts so small as to be mere walls or shafts are sometimes used, especially on town sites, which are open only at back and front, being closed in by houses on both sides. By this

means light may be introduced into the centre of the block; and if such a well is shared between two houses, it becomes double the size, giving so much better light and ventilation, without any greater expenditure of space.

This expedient is no new invention, as we see from the plan of Warkworth Castle (figs. 141, 142, p. 32). In such wells the air is generally stagnant, yet recent building Acts in towns, especially in Paris, have compelled their extensive adoption by forbidding narrow streets and passages, which, being open at both ends and having free circulation of air, are really much healthier.

In some recent attempts to legislate on building, the

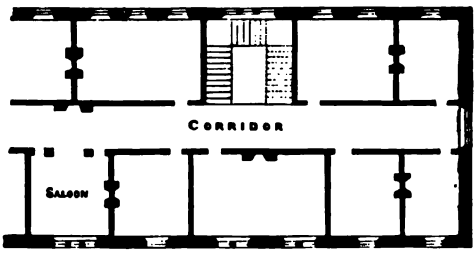


Fig. 151. PLAN OF CORRIDOR WITH ROOMS ON BOTH SIDES.

London authorities wished it to be decided that such courts shall not be less than twenty feet square, which on valuable ground is reckless waste, and which does not necessarily secure the object intended; for, in a court of that size, the air may be more stagnant than in a shaft eight or ten feet square, in which provision, such as opening it at the bottom as well as the top, is made to secure a through current.

In a house in the country, open on every side, such expedients ought not to be necessary.

When a house is large, a very noble and convenient disposition is to range it in a square—the corridor on the

inside, the rooms round it outside, looking out to the view. In this case the windows of the corridor, as there is no view from them, may be filled with stained glass, or the enclosed court may be roofed over with glass, to form a winter garden (fig. 163, p. 131).

This is the true Classic plan, which we find in the hall of the Roman house, surrounded by its open colonnade, and in the courts of Italian palaces, in which the corridors are ranges of open arcades.

If we omit one side of the square, we avoid the stagnation to which the air is liable in an enclosed court, and the corridors have the advantage of a view to the open. The house is fresher and more cheerful, but less convenient from the loss of the communication on one side.

By throwing the space occupied by the corridor in this plan into a more compact oblong form, we may obtain a great central hall (fig. 164, p. 132).

In the Classic houses of the last century, the ENTRANCE-HALL was usually made, in architectural character, a mean between the architecture of the outside and of the rooms; the floor being of stone, and sometimes also the pillars and door-mouldings. In some cases it was circular in form, placed in the centre of the house, with a domed ceiling from which it was lit. It was the entrance to the other apartments, like the mediæval hall of which it was the representative, and it inherited more of its size and grandeur than was required for its ordinary use, as merely an entrance and means of communication. It might, I think, in our modern houses, especially in the country, resume its mediæval character, as the chief room for the occupation of the family and guests, and for receptions, games and dances, with advantage. This would not destroy its use as an entrance-hall and as a means of communication, but the traffic of servants should be provided for independently of it.

They should not have to pass through it at their work or to open the door. The drawing-room might then be made narrower; a sort of gallery for conversation, in which the usual quantity of delicate furniture and works of art would be no incumbrance. In its arrangements and furniture, the Hall would be treated more like a room than like an entrance, with a wooden floor, either wholly carpeted, or in part, with rugs and strips of carpet in the line of traffic, and furnished with tables and chairs or benches and perhaps some carved cabinets.

The Hall may sometimes be two stories high, with a gallery round it, giving access to the upper rooms. It may be lit from the ceiling, and form a picture gallery; but lighting from the walls is preferable, with view and access to the garden. Whether used as a living-room or not, the hall should not enter directly to the open air, but should have interposed between it and the outside door an ENTRANCE-PORCH. This gives two doors between the hall, or entrance corridor and the open air, the inner of which should be a swing-door, to secure its being shut when the outer is opened, and to prevent a mass of cold air rushing in, which neutralises any attempt at heating the house. The porch will do its duty better as a wind-trap if it is placed at right angles to the corridor and not in the same line with it, when it allows the wind to blow freely in (fig. 165, p. 134). For its use in this respect the porch need not be of large size. It is usual now to pave it, and sometimes also the hall and corridors, with glazed tiles—a custom not without inconvenience, especially in country houses, as their slipperiness sometimes occasions serious falls, with iron-shod boots or snow sticking to the soles. The most practical if not the most beautiful floor-covering for it is a large door-mat, set, if need be, in a border of tiles or marble.

Tessellated pavements give a better foothold than tiles and are more beautiful, but more expensive. They are

formed of small chips of marble, in shape and size like dice (*tesseræ*) laid in hard cement in patterns or promiscuously. The chips are irregular in form, the cement forms a joint between them as hard as themselves. The surface is rubbed down smooth.

The access for the servants, in opening the door, should be through the porch, so as to leave the hall and corridors free from their traffic.

The MAIN ENTRANCE to the house should be placed, when possible, on the side opposite to the sitting-rooms, as they are thereby made more private, not being overlooked by every caller, and have a garden and lawn to look out on instead of a gravelled carriage-way. It also renders possible a better arrangement of plan, leaving the range of sitting-rooms unbroken, and making it possible to place the entrance-porch in the best position for it—between the family and servants' departments, so that the servants can open the door without passing through the hall and corridors (see figs. 162, p. 130, and 165, p. 134).

STAIRS.—As corridors and passages give communication between the rooms on the same floor, stairs must be provided for access to the different stories.

In old Gothic they are usually circular, the steps of stone turning round a solid central newel or pillar, and generally enclosed in a circular tower (see plans of Jacques Cœur's house at Bourges, figs. 139, 140, p. 28). Sometimes, however, flights of the steps when outside were straight—generally enclosed within walls, as in Wolsey's Hall at Hampton Court.

In Elizabeth's time the practice was introduced of having straight flights of steps with square landings, with an open space in the centre, the form which is still preferred. They were usually made of oak, with handsome carved rail or balusters. At this date the stairs became more handsome,

for they formed the approach to the principal apartments, which were not now, like the old English halls, on the ground-floor, but in an upper story, following Italian habits, which the miasma which is prevalent there and which is most dangerous near the ground had produced—an excellent instance of how fashion overrules reason. Since the Gothic revival we have returned, wherever the amount of ground at our disposal permitted, to the old English practice of placing the living-rooms on the ground-floor, which is more convenient and more sensible in this climate.

In small modern houses, and in servants' stairs in larger ones, a compromise is sometimes made to save space, by turning the steps at the corners where the landings should be; a plan always objectionable, as it destroys the continuity of the stair, making those turned steps, at the part we tread on them, narrower and steeper than the others, and likely to make people coming down stumble, especially when the ends of the steps meet in a point. It is less objectionable when they take a larger turn round an open newel. We soon get used to such a stair, the twist of the handrail giving us warning of the narrower steps. But such turned steps detract from the dignity and handsomeness of a stair. Still more objectionable is a long straight steep flight, such as is common in the smallest class of houses, which in towns where they are common, supply the hospitals with a good crop of accidents, from children and grown people falling down them.

In a good stair, all the steps at the part we tread on them, which is about eighteen inches from the handrail, should be of the same width. A circular stair with a wide sweep, in which this is attended to, is even easier to ascend than one with a number of short straight flights and square landings breaking its continuity.

The best gradient for steps is, on the whole, a tread of twelve inches to a rise of six or six and a quarter.

When they are steeper the stair does not feel easy; when the rise is more gentle than this, each step seems to require as much exertion to ascend, while a greater number is required to rise to the same level. When the rise of each step is less than six inches, the treads should be more than twelve wide, else we feel as if taking too short steps. When the rise is seven inches, the treads should be about nine. Those at the entrance door and in terraces in the garden somehow appear steep unless they are wider in tread and gentler in rise than this, perhaps in contrast to the level ground beside them.

From the greater elasticity of the material, a wooden stair always feels easier to climb than a stone one; and when made of hard and valuable wood, such as oak, it is handsomer. There is the objection that it is a collection of combustible materials disposed in the best way for burning. There is no objection to it when there is a stone staircase also in the house.

But even stone staircases, when built in the usual way, each step supported by its end in the wall, perish at once if exposed to fire, which nips them off at the wall line, at the point where the end, kept cool by being buried in the wall, joins the heated part. They will last longer in a fire if rested on wrought-iron girders. Steps made of terra-cotta, which, like bricks, have been burnt already, stand fire better than stone. Granite, as the Chicago fire proved, is one of the worst possible materials for fire, breaking into shivers, in a heat which a man could stand; marble is about as bad.

When a house has two stairs, if one is of wood the other should be of stone, or of some incombustible material. In London houses the servants' stair is usually of wood, as being kindlier, since it cannot have a carpet, and as wearing shoes less than a stone stair, and easier to keep clean, while the great staircase of stone is considered handsome and is not unpleasant when carpeted. In the country this

is usually reversed. There is no great risk, perhaps, in making both of wood.

For the *width* of a stair, four feet is ample, except in houses palatial in their disposition, in which it may be six or eight. But in London we have often to be content with something less than three feet. When it leads to reception-rooms, to which there may be a procession of guests arm-in-arm, a stair should be wider and handsomer than one only to bedrooms.

As to the position of the stair in the house no rule can be laid down. It may vary in every plan, depending on several considerations, especially that of lighting and on the number of stairs in the house. It is usually in a conspicuous position; but when the hall is used as a sitting-room, it is better adapted for the purpose if the stair is shut off from it at least by an open screen, by which means a very charming architectural effect may be produced.

Even in moderate-sized houses a separate servants' stair is desirable, as it keeps the chief stairs and thoroughfares clean by relieving them of the rougher traffic. It should be enclosed from top to bottom, communicating only by doors on each floor with the passages of the house, which should swing shut of themselves, else it may introduce into the house draughts and kitchen smells.

In larger houses when there is a separate family wing, containing master and mistress's bedrooms and private sitting-rooms, with nurseries over, there will be an additional private stair connecting them. Additional stairs, like long passages, increase the trouble of keeping the house in order and require a larger establishment.

CHAPTER VI.

COMBINATION AND ARRANGEMENT IN HOUSE-PLANNING.

WE have now described the various rooms of a house, with the offices which modern convenience requires, and the communications—the passages and stairs—by which they may be united. The task remains to show how these may be combined together so as to form a properly arranged and convenient house.

We need not confine ourselves by considerations of consistency of style in the plan to any single system. Any one may be used as occasion demands. In overcoming the numberless difficulties in actual work, resort must be had to every expedient, so as to combine all the advantages possible. At best we have often to choose between a balance of disadvantages. We cannot always, for instance, have the main entrance between the servants' apartments and the family living-rooms, or every chimney in an inside wall, without sacrificing more essential arrangements, such as proper lighting, or the right position of the fireplaces in the rooms; yet, by not sparing labour in trying every

possible combination, a right solution may generally be found for problems at first apparently hopeless.

In perfect planning, expedients should never be obvious; art should conceal art. Every requirement must be met simply and naturally, as if it had been done without difficulty. To make a complicated plan, however clever it may look, is easy, compared with one in which this is attained.

The method of applying the principles of house-planning, and the results of experience in it, will be best illustrated by showing different modes in which a house with the usual three sitting-rooms may be arranged.

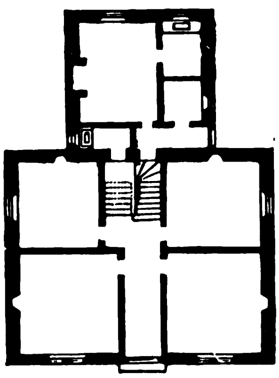


Fig. 155. ORDINARY PLAN OF A HOUSE.

The plan of last century was governed by the old Classic traditions of symmetry: the door in the centre of the front, on the same side as the sitting-rooms; the stair facing it, and an equal number of windows on each side of it; the kitchen offices in a "back jamb" (as it is called in Scotland) one story high, entered under the stair, with the stair window over it (fig. 155). Fig. 156 shows the appearance of the sort of house which this plan usually produced.

This plan is still followed by builders, and is liked by many people, as making "a plain square house, which cuts up well."

Symmetrical wings were sometimes added at each end

Fig. 156. ORDINARY CLASSIC HOUSE.

(fig. 157), entered either by a passage, as at *a*, or through one of the sitting-rooms, as at *b*.

The same plan is also adopted for Gothic villas, the irregularity supposed to be necessary in the style being

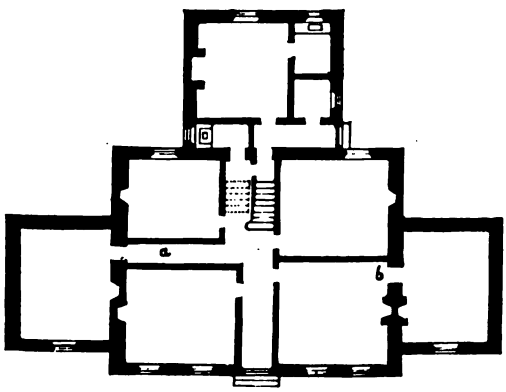


Fig. 157. HOUSE WITH SYMMETRICAL WINGS.

obtained by making a gable over the window on one side of the door, and not on the other, or by leaving out a room on one side (fig. 158).

It is obvious, however, that in all its forms this plan misses many of the points which we have stated as desirable in modern house-planning; and arrangements are possible, both more artistic and convenient, of which it may be useful to give some specimens, accepting the principle that in our domestic architecture now, whether Classic or Gothic, either symmetry or the want of it is a matter of indifference.

In planning a house we must first decide on which side the entrance is to be, and which way the principal rooms should look. The position of these may differ on every site. The views which can be got from the windows are

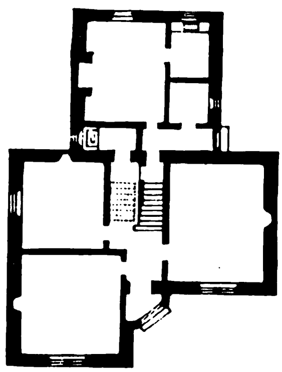
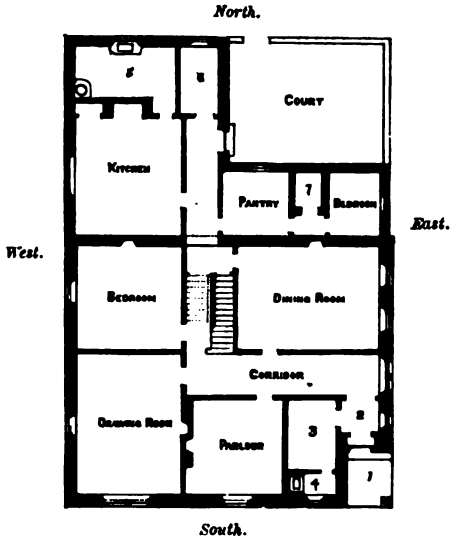


Fig. 158. PLAN OF MODERN GOTHIC VILLA.

one element in the decision, but a proper aspect is of more importance.

The sitting-rooms will usually face southwards; and if, for any reason, the entrance must be on the same side, it is better, in order to secure their privacy, to place it not in the middle, but at one end of the front—let us suppose at the east corner, as in plan A (fig. 159). The dining-room, in order that its access to the pantry and kitchen may not be across the main corridor, must be placed behind it, and as a western aspect is, as we have seen, unsuitable, it faces the east.

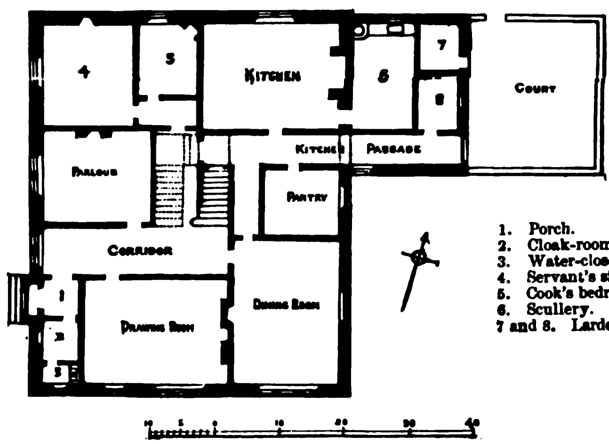
If the entrance is on the west side, it will not do simply



1. Open porch.
2. Inner porch.
3. Cloak-room and lavatory.
4. Water-closet.
5. Sculleries.
6. Larder, open to north and east.
7. Plate-safe, between pantry and butler's bedroom.

Fig. 159. PLAN A.—HOUSE WITH ENTRANCE ON EAST SIDE.

to reverse the plan, for this would bring the dining-room to



1. Porch.
2. Cloak-room.
3. Water-closet.
4. Servant's sitting-room.
5. Cook's bedroom.
6. Scullery.
7 and 8. Larders.

Fig. 160. PLAN B.—HOUSE WITH ENTRANCE ON WEST SIDE.

the west. It must be kept to the east; and as the entrance

in this case, being at the other end of the house, does not cut it off from the kitchens, it may be brought to the front, as in plan B (fig. 158).

It will be noticed that the plan of this house, as of A, is a simple oblong, without projections, except the kitchen offices. It is easy to make projections in a plan, and this is often done merely for the sake of architectural effect,

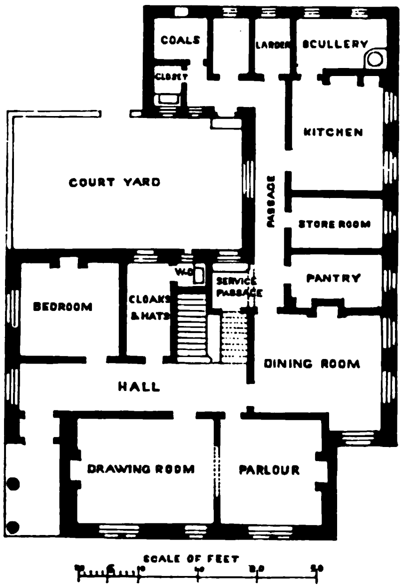


Fig. 161. PLAN C.—HOUSE WITH ALL THE LIVING-ROOMS TO THE FRONT.

which can be got without it. They should not, I think, be resorted to, except to attain some convenience.

In both these plans the parlour is commanded by the entrance; but in plan C (fig. 161) this is obviated by giving it the place of the dining-room in B, and projecting the dining-room beyond the front, so that while it still remains in connection with the offices it retains its southern view.

In none of these plans, however, is the entrance in direct communication with the offices; and as it is at one end of

the house, a long narrow corridor is required to connect it with the rooms. If we can place it on the opposite front from the sitting-rooms, as in plan D, it is in direct communication both with these and with the offices, which are still beside the dining-room; and instead of the corridor, we may have, with less expenditure of space, *a hall* with the staircase at one end, which may form a useful addition to the sitting-rooms, which, again, are in an unbroken range and may if desired have doors of communication between them.

The changes which, as these examples show, are rendered

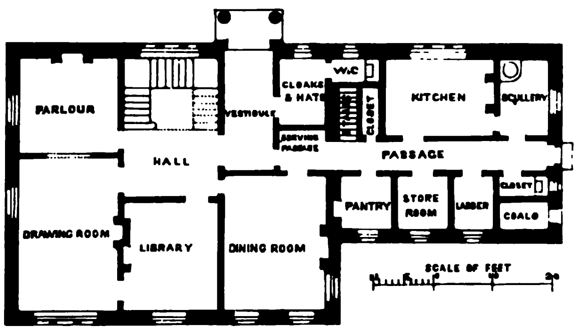


Fig. 62. PLAN D.—HOUSE WITH ENTRANCE ON OPPOSITE SIDE FROM SITTING-ROOM.

necessary by the single circumstance of altering the position of the entrance door, will give some idea of the numberless considerations which must be taken into account in planning every house.

These plans may be taken, in their general features, as examples of actual houses, as I know from my own experience that similar arrangements have been found satisfactory in execution. But each of them is susceptible of numerous modifications, from such circumstances as the proper aspect and view for the different rooms; the conformation and size of the site, or some features of it which may be worth preserving, such as a row of old trees; or

the best position on it for the servants' offices, as well as modifications of the internal arrangements, such as bringing the hall forward to put it into direct communication with the garden. Any one of these alterations may necessitate a revision of the whole plan.

The next two plans show the requirements of a larger house than those just given; I have made them chiefly with the view of illustrating two different methods of communication between the public rooms.

It will be remembered that old English houses were built

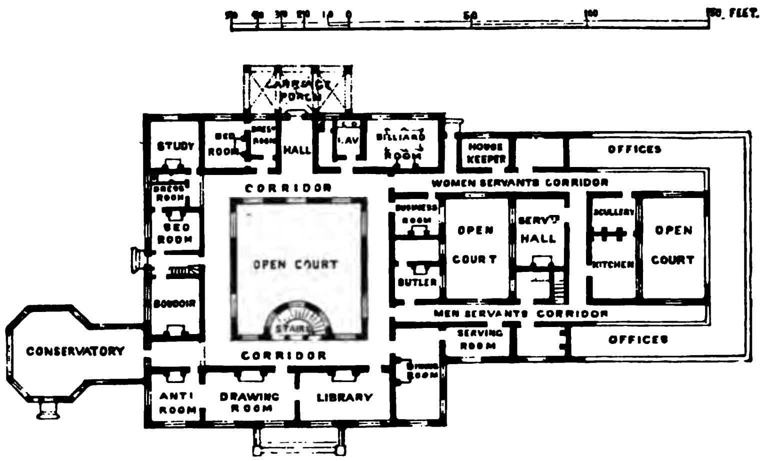


Fig. 163.—HOUSE WITH CENTRAL COURT AND CORRIDORS.

like colleges, the rooms being ranged round a court or quad, through which we have to pass to get from one set of rooms to another. See plan of Yanwath Hall (fig. 134, p. 16).

It was an obvious improvement to make a cloister round the inside of the court, so as to give communication protected from the rain between the different sets of rooms, and a further improvement to glaze this cloister with windows, so as to make it part of the house and give it warmth as well as dryness. Fig. 163 illustrates the plan at this stage

of development. It is arranged with a view to symmetry and regularity in architectural design, it would probably be treated as a great square Classic house.

Fig. 164 shows the same rooms in similar positions. But the back and the front ranges are brought closer together, so as to leave between them, instead of the open court and corridors, a great hall, lighted from the ceiling which gives shorter and better communication between the rooms and, at the same time, gives, instead of long corridors not useful for any purposes of life, a large room, which

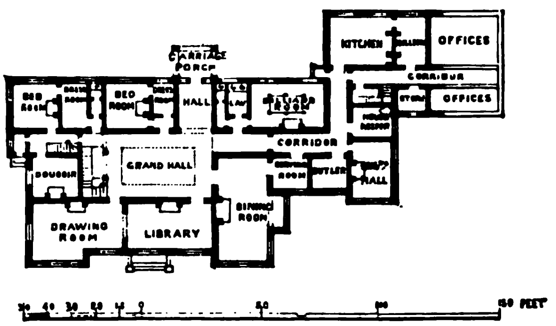


Fig. 164. HOUSE WITH CENTRAL HALL.

would make a good picture gallery, and might be used for dancing or the entertainment of company. This hall might be two stories in height, with a gallery round it for communication with the rooms on the upper floor.

Roof lights, however, are apt to be troublesome. They leak sometimes, or get blocked up with snow, or a slate blown from the roof comes through them. It would improve the plan to give the great hall windows to the north, by removing the bedroom and dressing-room on this side, and as these might be placed over the great hall, which would not now require roof-light, the accommodation of the house would not be lessened. This would involve other

changes; the bedroom and dressing-room to the north-west would be better thrown out as a wing to the west, in line with the hall.

These plans, though intended merely as illustrations of arrangements, give an idea of the usual accommodation of larger country houses. Besides the dining-room, library, and drawing-room, they have on the ground-floor the private suite of the master and mistress, consisting of bedroom and dressing-room, with water arrangements, and boudoir; and, in the larger plan, the master's private room.

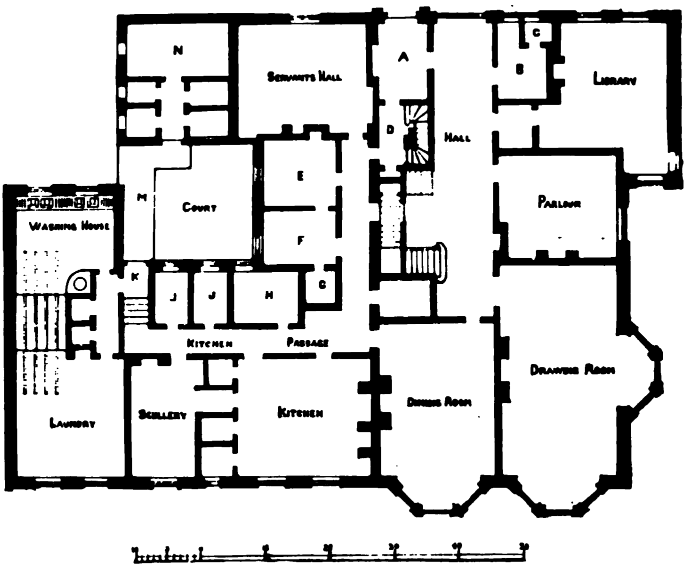
This suite has a porch to the garden, and a private stair to the nurseries and children's rooms above, so that it is a little house complete in itself, where the family might live retired in a house full of guests.

Another bedroom and dressing-room is provided on this floor near the entrance, where ladies arriving as guests for the evening might disrobe, or for older people to whom climbing stairs is a burden. Probably one good sized room, which might be used for other purposes, might be more generally useful.

One of the great difficulties of designing a house is to adapt it to the scale of living of the family; arrangements which are excellent in a small house being out of place in a grander one. And it frequently happens that people adapt their new house to a scale of living, which, when they get into it, they find they have outgrown; or, on the other hand, that they burden themselves with a house too large for them, which it is a toil to live in.

It is always safe, in a country house especially, to have one great room; in this case we may dispense with great size in the others. This room should, I think, be made like the Hall of an old English house, which may be used for a dinner, or a dance, or sports, and even when the family is alone is not unpleasant as a sitting-room.

The accompanying plan of a house which I lately built at Westoe, near South Shields, may be useful, as an example of how the requirements of house-planning, which have been enumerated in this chapter, may be combined.



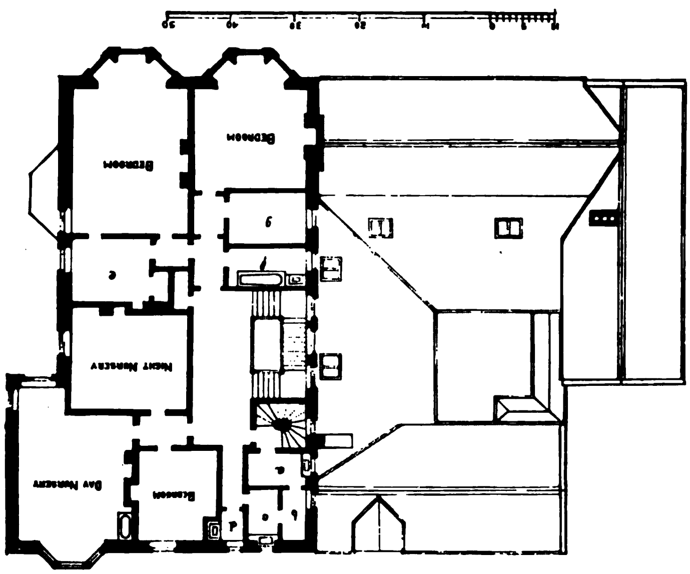
A. Vestibule.
B. Cloak-room.
C. Water-closet.
D. Servants' stair.
E. Pantry.
F. Butler's bedroom.
G. Plate-safe.
H. Store-room.
I. Larders.
K. Servants' entrance.
M. Covered passage.
N. Coals.

Fig. 165. HOUSE AT WESTOE.—PLAN OF GROUND-FLOOR.

It is built on the south side of a village, with a garden in front. The entrance porch, or vestibule A, came conveniently in its proper position to the north, as the dining-room and drawing-room to the south, overlooking the garden. The servants' hall was ordered to be placed overlooking the village street, as more interesting to its occupiers. Its position is also convenient as a waiting-room for such visitors as would not be shown into the drawing-room. It was desired that the library should have the same outlook, but it has also a projecting window to the south, overlooking the garden. The site is comparatively narrow and

the plan had to be made deep from back to front to get the required accommodation, an additional room being interpolated between the drawing-room and library.

The offices are one story high, so that light over them is



a. Housemaid's closet. *b.* Coal store. *c.* Nursery scullery. *d.* Water-closet. *e* and *g.* Dressing-rooms. *f.* Bath and water-closet.

Fig. 166. HOUSE AT WESTOE.—PLAN OF BEDROOM FLOOR.

got for the staircases and smaller rooms of the bedroom floor of the house. The kitchen is placed so that its chimney is carried up in the wall of the main house above all windows, which might otherwise let in the odours of cooking. The washing-house and laundry are so planned that the clothes-horses may be run from the one into the other. The destination of the other offices may be seen by reference to the lists.

The upper floor is occupied by two bedrooms to the front, each with its dressing-room, and a bath and water-closet beside them; and towards the village by a nursery suite of day and night nurseries, completely shut in with a

little vestibule of its own. The day nursery has also a southern exposure. Close at hand, but outside the porch, to avoid any risk of smells, are a water-closet (*d*), nursery pantry (*c*), and coal-closet (*b*), which is also accessible from the housemaid's-closet (*a*), in communication with the back stair.

A second story adds the number of necessary bedrooms for the family and servants. Every part of the house is well lighted, though from the plans, without additional drawings, this may not be obvious.

The first step in planning a house is to ascertain the amount of accommodation required, so as to determine approximately the size of the building, and the amount of ground which it will occupy, for which purpose a small tentative plan may be tried; and it is well also to know the sum which it is proposed to spend, as this must affect the scale and the arrangements.

Before any real progress can be made in the plan, the site must be studied, so as to know the levels, the direction of the views, the quarters exposed to violent winds, that we may avoid opening to them doors and large windows; the best positions for the approach, for the flower-garden and lawn, and for the servants' department, courts, stables, drying-green and kitchen-garden, which should be lower than the house so that the sewage may drain into it.

The best form for the house on the site should be ascertained, for it sometimes happens that its erection destroys the features which had given the site its charms and led to its adoption.

It may depend on the levels of the ground, whether underbuilding should be utilised on a basement story, a circumstance which would affect the whole arrangement of the plan. The scenery may be such that a high house

would ruin it, thus compelling us perhaps to take off a story and spread the house out more on the ground. A single hurried visit will hardly be sufficient to enable us to determine the best site for the house and the best form of the house for the site.

Choice of Site.—The sites of old houses, especially of old religious houses, were chosen with perfect knowledge, from long experience of the locality, of the prevailing winds and of the climate, and they are almost always the best that could be had—that is for their owners' purposes. They did not care for views. Abundant water was a chief necessity. The Cistercian monasteries, whose enclosures the monks in some cases never left, were placed beside rivers which sometimes flowed through them. Other Orders built on heights as a penance, because they disliked mountains and rocks and picturesque scenery. Old castles were built on heights from the necessities of defence. As soon as they safely could, their inhabitants deserted them for the low ground. To live on a mountain was a penance.

Old houses got shelter, and pleasant aspect, and convenience of water, and an outlook if possible on the village street, the doings of their fellow men having much more interest for them than views and prospects. They lived in their country houses through the winter and bleak spring, and the most important thing was shelter. We go to the country now to get away from our fellow men, and nearer nature. A wide expanse of view delights us. Hence modern houses are placed on cold windy heights, and mar the scenery. A house though placed in an exposed situation need not be cold to live in, if it is well built. For the walls may be thick, the windows tight-fitting, and the house sufficiently warmed. It is an error, too, to suppose that a high situation is always colder than a lower one. It is usually dryer, especially if the soil is gravel or sand or some porous formation, which carries off

the moisture; not clay, which retains it like a sponge, and exhales it again in fog. Damp is more unpleasant and injurious to health than dry cold, and a damp fog may frequently be seen overspreading the valleys and lower ground, while the higher ground beside them is in clear sunshine. Plants are often killed by frost in low situations, while those on higher ground near them escape.

By our modern appliances we can overcome the difficulties the old builders had of getting water on high situations. We want when we go to the country a dry bracing atmosphere and extensive views. Consequently modern houses will usually be built in high and conspicuous situations. Whatever our aim as to a site, right determination is so important that it would sometimes almost be worth while to build a temporary house on trial.

Having got those data, and having approximately fixed the size of the rooms, we try to arrange them together, so as to combine the greatest number of advantages. The best general arrangement may be obvious from the first, but even in this case there is room for infinite trouble in perfecting it. Half-a-dozen plans may have to be made before we can decide, and no pains should be spared in trying every possible disposition, so as to find out that which on the whole combines most advantages. It is certainly a foolish saving to spare pains or cost in what may make all the difference between a house, which, from its convenience, will be a pleasure to live in, and one which the owner wishes he had never built.

Let everything, as to the plan of house and grounds, be settled before the work is commenced; for alterations during its progress often involve others which had not been contemplated, causing expense which might have been avoided, and sometimes spoiling the plan.

It is most desirable that the owner should know, before his house is commenced, what it will be when finished; else,

however good in its own way, it may not be what he likes or expected.

In many cases he goes through a course of practical instruction in architecture in the building of his own house; his interest in the subject growing as the work progresses, he hears of features and arrangements which he makes alterations to adopt, and is ready at the last to lay out money to save a portion of which at first the design had perhaps been spoilt. This is, I believe, the chief cause why houses so often cost more than was at first intended; for any architect or builder who knows his business can provide and estimate from the first for everything necessary on the scale of accommodation and richness intended.

For this reason a knowledge on the part of the owner of the features in design, and the conveniences in plan attainable in a house may render it possible to lay down from the first a consistent scheme, which will not have to be altered in accordance with his newly-acquired knowledge, and may prevent his finding out only when it is executed that his house does not suit him.

CHAPTER VII.

HEIGHT OF HOUSES AND NUMBER OF STORIES.

EXCEPT in rare and exceptional instances, the accommodation we have described as necessary, even in small houses, cannot be obtained on one floor-level. The restricted extent of sites, as well as other considerations, necessitates the piling of the rooms in floors or stories one above the other, with stairs connecting them.

In this respect different fashions have at different times prevailed in this country. Saxon houses continued the tradition of the villas which the Romans had left in the land, straggling out over the ground in a number of buildings of a single story. The Normans were compelled to defend themselves from the people they settled among, and consequently restricted the sites of their castles; so that, with their courts, they could be enclosed within strong walls, with a strong tower or keep to give command over the attack, and to retire to in the last resort. When the hall formed part of this keep it was always upstairs, as windows on the lower stories of the size necessary for a

family living-room would have given dangerous facilities to the attack. The ground-floor was consequently used as kitchens and cellars, or in Border districts, down to much later times, for driving the cattle into for safety from the raids of neighbours. Frequently, especially in the larger castles, such as Newcastle-on-Tyne, the hall was a separate unfortified building, sometimes of wood and plaster, within the castle garth, on the ground-floor, which English custom seems always to have preferred to upper stories for family living-rooms.

But the inroads of Italian architecture in the sixteenth and seventeenth centuries, brought with them the arrangements of Italian palaces, in which, from the traditions or continued necessity of defence and probably also to avoid the miasma which in that country often hangs about the ground, the living-rooms are always in the upper stories. The sole object of the ground-floor being to raise these above the ground, it was used merely for cellars, sheds, or stables, and appeared on the outside a dead mass of wall built of enormous stones, with only the smallest openings. This arrangement, which gives great dignity to the external architecture, is still followed in some modern houses in Paris.

While the Classic fashion prevailed, it was essential to an English mansion to have not only the portico of a temple, but the rusticated basement of an Italian palace, which was utilised for kitchens and servants' accommodation.

But about the beginning of this century, old English customs returned. "The chief apartments," says Britton (who did good service in his day by his architectural publications), writing in 1825, "instead of being raised on a basement, as in the Palladian villa, separated from the terraces by flights of numerous steps—at the same time the stately and dreaded means of approach, unless interior staircases were formed to the basement, and which

were objectionable, as they were gloomy or connected with the offices, so that the gardens were rarely visited but at stated periods of the day, and then attended with all the preparations for an excursion of some duration—are brought so near to the level of the lawn that it has taken the place of paved terraces and gravel walks, and its verdure and decorations have become almost a continuation of the furniture of the morning and drawing-rooms."

Even in these circumstances the basement story was sometimes still retained, buried wholly underground, damp and dismal, lighted only through gratings level with the ground, the kitchen-court a sunk hole with access by an inclined plane; or a sunk area was formed round the house, so that it rose out of a dry trench—the system still usually followed in our town houses.

As we are not bound by the necessities of defence, and may disregard the traditions of it, we may consider ourselves free to adopt whatever arrangement has the balance of advantages in its favour.

The pleasantest for the chief apartments is certainly to place them on a level with the garden, so that access to it is easy; but as we now properly object to bury the servants' rooms and offices underground, these must be spread over it, and from their enormous development, they cover, together with the house, an immense surface of ground—more, often, than can be afforded. Where space is ample, this is generally the best arrangement. It avoids the necessity of stairs, which are always more or less an evil; and as the servants' department need not be high, it need not be conspicuous.

An arrangement which combines several advantages, is to sink the basement containing the servants' rooms about four feet into the ground, its windows being wholly above it, thus avoiding all areas and holes for lighting, and permitting the house to be seen, as it ought to be, rising from

the surface. But as in this case about five or six feet of the basement is above ground, about a dozen steps are required for descending from the principal floor to the garden. The windows of the servants' rooms also look out on the garden; and though the view from them may be shut out by obscured glass and shrubs planted before them, and though the rooms only of the housekeeper or other confidential servants may be placed in this position, the conversation of the family is liable to be overheard, and the privacy of the garden destroyed. On the other hand, the plan has the advantage not only of saving space, but when there are any bedrooms on the principal floor, of raising them somewhat above the level of the ground.

A satisfactory compromise may be made by adopting this plan on several sides of the house, but dispensing with rooms in the basement on the garden front, and raising the ground there into a terrace, so as to be more nearly level with the principal floor.

But the Italian system of a basement wholly above ground need not have the inconvenience which Britton describes, of having only servants' stairs inside, or magnificent flights outside, in passing which we may be drenched with rain between the door and our carriage. The entrance may be at the ground-level, with a carriage porch, if need be, for shelter, with hall and stairs inside; while several of the family rooms—such as school-room, billiard-room, business-room, or study—may be advantageously placed in such a basement, avoiding the inconvenience of making servants' rooms overlook the garden.

The decision as to which arrangement is best must depend on circumstances special to each case—the extent of the ground, and its elevation and levels—the likings of the proprietor, and the advantage of dignity which a basement gives to the architecture.

In the country where the site is practically unlimited in

extent, it is better to spread the house over it than pile it up in a number of stories. It is more convenient, and pleasanter to live in, for the necessity of perpetually climbing stairs is a considerable addition to the burden of life. In any case, let all the principal rooms be on one floor, else their usefulness will be materially lessened; for if they are on different levels, they are not so serviceable for the entertainment of company, and a doubt will always arise whether the advantage of change will repay the trouble of mounting to them. Besides, a high house makes an unsheltered garden; for the wind which would pass over a low house is caught by a high one, and its force is not spent, but turned, scouring the garden and blowing down the plants, so that nothing grows well.

A high house is no doubt more conspicuous in the landscape, and may have the appearance of a fortified castle more easily given to it; but it is less like a home, and the landscape would in most cases be better without it.

Most modern country houses are much too conspicuous in the landscape, especially considering the great numbers of them which are being everywhere built. In most cases high houses jar with it, and look out of place. Where the land for miles round is attached to it, there is some meaning and excuse in making the house conspicuous and commanding, though even in such cases the low-level lines of the English Tudor house are in better taste, and more in harmony with English scenery. A house with only an acre or two round it which looks as if it commanded the country, is in bad taste, and even impertinent. One difficulty in making our modern houses as modest-looking as old ones is that we are so fond of views, that we select the sites where the house commands a wide landscape, and is consequently conspicuous. Another is the much greater amount of accommodation we require, which usually causes them to be made three stories high.

If we spread the same accommodation over the ground in two stories, it might cost somewhat more, but the house would be more convenient to live in, and, being less pretentious, would not spoil the landscape. Modern taste, trained in modern Gothic notions, loves height. Our houses almost always have towers, not because they are wanted, but in order to be conspicuous. English taste formerly, formed on Tudor and Classic ideas, preferred long low level lines.

Another cause of the great height of our modern houses is our liking for high ceilings. I believe that, in the country especially, this is a mistake. Such rooms are not so comfortable looking. They are much more difficult to light at night, from the larger space to be lighted and the greater distance of the reflecting ceiling. Nor is their advantage in giving us fresh air and ventilation nearly so great is is usually supposed; for if the air in the room is stagnant, as in most cases, foul air will accumulate at the top from the ceiling downwards. With lofty ceilings it will no doubt take longer to reach to the level at which it would be breathed; but half an hour longer of purer atmosphere may be all the advantage gained by the height; while, if the room is ventilated, so that the foul air is carried off, a low room may continue as fresh as a high one.

In Italy, where in summer, on account of the heat during the day and the danger of miasma at night, the rooms are kept closely shut and the air in them changed by opening the windows only in the morning and evening, it is essential to have them not only large but lofty. There is a magnificence in the idea of those great Italian churches, with a cool fresh atmosphere of their own, renewed occasionally by opening the great doors to the cool western breeze; but in this country it is better to depend for the freshness of the atmosphere, both in our churches

and houses, on continual renewal than on enclosing a large stagnant quantity of air. Even in bedrooms, where this is sometimes desirable (as it is not always wise to keep the windows open at night), large low rooms are as efficient for this purpose, and more convenient for others, than small high ones.

On the other hand, loftiness in rooms may sometimes be desirable for the sake of the architectural effect of dignity and grandeur, and for the feeling of air and space. The question then becomes one of proportion; and it is to be remembered that low proportions may give a different, but not less valuable effect of pleasant homeliness and beauty, and of extent and space.

By skilful planning it may sometimes be managed to make some rooms, such as a hall or reception-room, more lofty than others less important, by dividing the total height of the house in the proportion for each of one story to two, or two to three. In this case the different floor-levels should be reached not by special steps down to them, but by landings at their own level in the general stairs of the house.

Both high ceilings and low ceilings are right—each in its own place and for its own purpose. In every case, the question will be decided by individual liking and the effect which it is desired to produce; regard being had to the objections to the appearance of height in houses especially in the country, which lofty ceilings tend so far to increase.

CHAPTER VIII.

TOWN HOUSES.

THE general disposition and plan of town houses have remained the same since the Middle Ages. The plots for their sites have been laid out in the same way, and the plan of the houses has had to conform to them.

In laying out ground along a street for houses, in order to make the most of it, the problem is to divide it into as many sites as possible, each large enough for a house of the size required, and each with frontage to the street. The solution was soon found to lie in dividing the ground into narrow strips, each set endwise to the street.

This plan saves expense in several ways; the proportion of street with its outlay of paving, lighting, drains, &c. is reduced to a minimum for each house, as is also the front exposed to view which must be architecturally treated; the main bulk of the enclosing walls are party-walls, built as plainly as possible and the expense shared by the neighbours on each side. The towns founded in France in

the reign of our Edward I., many of them by him, were laid out on this principle.

At first the blocks were separated by narrow alleys, but this was soon found to be a needless waste of room and of building, necessitating two walls where one party-wall would better serve the purpose.

From that time to the present day there has been a gradual course of progress in increasing the accommodation in such narrow frontages; the space being better utilised and the height and depth of the houses increased as the land became more valuable.

In some London houses this has been overdone; a drawing-room as large as an old baronial hall with twenty or thirty other rooms being got out of a frontage of twenty-five feet. But the piling up in the air required to get such accommodation has its inconveniences. The long stairs render life a burden, especially to servants. It is like living on a ladder instead of on the earth's surface.

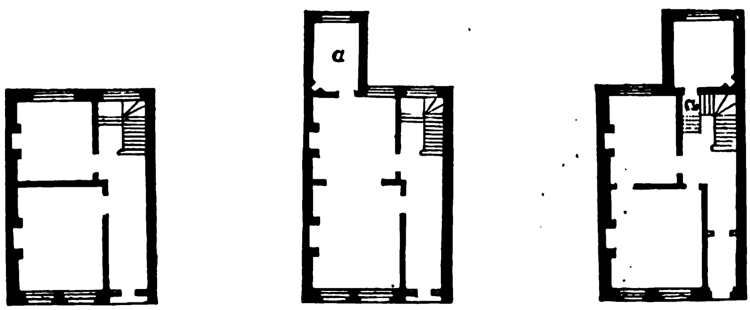
The French system, where each house is one great floor, avoids these evils. It is being slowly introduced in various forms into London, and for smaller houses will probably become more common. But social habits are not readily changed, especially when those of servants have to be taken into account. Nor would it be easy to find space for all the accommodation required in a large English family house on a single floor. A French *étage* has seldom more than six bedrooms, the servants from all the floors being sent to sleep in the attics, which our housewives would not approve of, and which not unfrequently leads to mischief. We may therefore expect that town houses, on the present system will continue to be built and occupied.

The difficulty of planning a house on these narrow plots, is that light and air can be got only on two sides—at the front and at the back of the narrow plot, the sides being party-walls, without openings in them. So long as only

two rooms were wanted on each floor the problem was easily solved—they could be lit one from the front, the other from the back of the building, as in Plan A. The difficulty was how to add another room, without blocking up the light, either of the staircase or of the back room.

The Gothic builder in the Middle Ages left an open court at the back of the building, and across this court put a third room, sometimes but as often not, making a covered passage to it.

In Queen Anne's time the third room simply entered off the back-room, as in Plan B; an arrangement which Dean



PLAN A. *Fig.* 167. PLAN B. *Fig.* 168. PLAN C. *Fig.* 169.

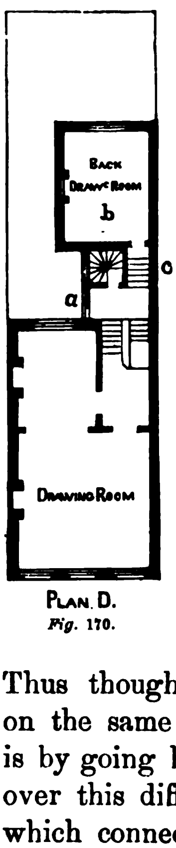
PLANS OF TOWN HOUSES.

Swift ridicules. Sometimes an attempt was made to obviate its inconvenience by placing a servants' stair at *a*.

Of late years the common plan in London has been to place the third room at the back of the staircase, as in Plan C, with its entrance at the halfway landing of the stairs (*a*), the staircase being lighted over it. This gives also a low room on the ground-floor, which is sometimes down a few steps, in order to give some additional height of ceiling, and another under it in the basement. The space in the roof, entering from the half-landing above the drawing-room, is usually occupied by a bath and water-closet. For small houses it is probably impossible to improve on this plan.

In Scotland the usual mode of getting over the difficulty

has been to put the staircase in the centre of the house and light it from the roof by a cupola. This leaves the back as well as the front available for window-light to rooms. It is an adequate mode of lighting, when, as is usual in Scotch towns, the houses have only two or three stories above the ground, but, in a tall London house of five or six stories, the light could barely struggle down the narrow staircase. The London mode is pleasanter also, and gives much better ventilation. But the Scotch plan has the advantage that it makes the rooms all on the same level, not as in the London plan entering off the half landing of the stair. This plan was introduced into London by the Scotch architects, the brothers Adam, but it was never generally adopted by the London builders.



PLAN. D.
Fig. 170.

In larger houses another expedient is resorted to. The frontage of London houses being limited, greater size is got by carrying them farther back, and lighting the stair at the side, as at *a* in Plan D.

A back room (*b*) of this size must have greater height than it would have if the floor of the room over it were at the level of the half pace of the stairs, and, consequently, steps are required up to it at *c*. Thus though the front and back room of the house are on the same level, the only communication between them is by going halfway downstairs and up again. I have got over this difficulty in some houses, by providing a gallery which connects the back and front rooms on one level—a matter of considerable importance in rooms the purpose of which is to entertain great companies—for it is found that the trouble of going half downstairs and up again, to get to this back room, will prevent the company from using it.

And another disadvantage of the ordinary plan is that is does not provide for circulation. There is much less chance of blocks in crowded rooms when each has two entrances, and the company can circulate in a continuous stream, instead of meeting in one doorway in two opposing streams. Guests cannot retire unobserved, but must pass the hostess stationed at the door to receive new comers making formal adieus, which it is sometimes convenient to avoid.

Fig. 171. HOUSE AT ORLEANS.

An investigation of the gradual development of the present ordinary plan of London houses shows how the minds of builders have been occupied on it for centuries, and by what slow stages it has arrived at even its present state of perfection.

At one stage of growth a peculiar feature of the design of the front was the little window over the entrance on the first floor, lighting the stair and a passage. It does not seem to have occurred to the builders that this was waste of the frontage, that the stair might be put at the back of the house, and the passage thrown into the front of the *belle*

étage making it so much larger. The house at Orleans (fig. 171) exhibits this feature, and I have seen the same arrangement in a London house of this century.

These examples I have given show some of the difficulties which occur in the planning of large town houses, and they are by no means all. It would be tedious to discuss the difficulties of finding positions for the servants' stair, lavatories, and water-closets, and giving them all proper light and ventilation. They can, I believe, all be overcome by pains and ingenuity. One difficulty, which spoils the design of many modern houses, is, that the sites are not laid out deep enough for the great amount of accommodation now required, and the stables are consequently only a few feet from the back windows.

In England, every house, however humble, stands on its own ground. This is by no means the case elsewhere. In French towns, and in Paris especially, only the finest are in one occupation from basement to roof. The bulk of French town houses consist of a single story, or part of a story of a large block of buildings. The same custom prevails, though in a less degree, in Scotland, it is common in continental towns and it was a special characteristic of ancient Rome.

The English practice, though any other seems strange and impossible to us, is really exceptional, and frequently unreasonable. It accords with our habits of family exclusiveness, and it has been fostered by the maxims of English law, that an Englishman's house is his castle, and that the ownership of land includes the earth beneath it and the heaven above. In Scotland one man may own a single flat or story of a house, the stories above and below belonging to different proprietors.

The English custom has affected the manner of growth of English towns, spreading them out in little houses over a wide extent of surface. This is healthier than the close

packing of the inhabitants on a limited area in tiers of houses one above another, five or six stories high, as in the old parts of Scotch towns. But it gives an air of meanness and commonplace to English towns. The dreary sameness of the square miles of regular streets and mean houses in towns like Manchester is unknown in the poorest parts of continental towns. It is healthier than close crowding, but, given the number of inhabitants to the acre, it would probably be healthier and would certainly produce a better architectural effect to dispose them in houses double the height and leave double the open space round them.

The regularity in the width of streets produced by our building Acts, instead of promoting the circulation of air, tends to make it stagnant. An irregular arrangement, with narrower streets, and wider open spaces, would tend to produce a movement of the air, and to correct its stagnation in hot close weather. For it would make varieties of temperature; the open spaces getting warmed by the sun, a current of air would flow into them from the narrower streets leading into them. If, instead of the regular streets and low houses of the poorer parts of our towns, we made the houses taller and disposed the ground thus gained in wider and narrower spaces round them, the result would not only be better in architecture but healthier.

The growing scarcity of land in central situations, especially in London, is beginning to modify the English dislike to making houses in single stories or flats one above another. It has long been the custom for poorer families to live in single stories or rooms of a house. When a situation became unfashionable, a house, originally built for the occupation of a single family, was "tenemented," as it is called. Usually it was rented by one family, who occupied the kitchen, and let out the remainder to other families. The system leaves much to be desired; the different families

in a house intended for one only are in too close contact. But the houses exist, and it would not pay to alter or rebuild them. Happily, blocks of workmen's dwellings are being built here and there, where each family has a complete little house with proper conveniences enclosed within its own door.

And it is beginning to be seen that a similar system is suitable for smaller houses in fashionable situations. It was first tried in Victoria Street, about thirty years ago. For a long time the houses would not let, but the prejudice against the system seems to be removed, and they bring good rents, and new blocks of houses on the same system are being built.

A modification of the system, to which the name of "mansions" has been given, has had considerable success. The inordinate height to which some of them have been raised is not probably essential to them. These are really hotels, in which the rooms are taken, not for a night or two, but for periods of years, and are furnished by the occupiers. They suit many people. Those whose home is in the country can have a house of their own in London, which they can come to without notice, without the trouble of keeping a separate establishment. Others like to be freed from all cares of servants and housekeeping, and to have when they wish, the society of the public room.

Such establishments, however, are not intended to be English homes. With the advantages of an hotel they have some of its disadvantages. They do not provide a house with the isolation and self-containedness which our family habits demand. Smaller houses in good situations are desired by many people, who, provided they were arranged more in accordance with our habits, would not object to their being part of a large block, especially as this gives the advantage that all the stories can be reached by a lift. Some modification is required from French étages or Scotch

"flats." Each house should be self-contained, including accommodation for servants and all conveniences within its own door. It would be necessary to have a porter to provide for communication of callers with the upper floors, but independent communication from the entrance might also be provided for each house by means of a speaking-tube, and small lift for messages and parcels. Each house too, might even have a space or terrace where one could be in the open air without the necessity of descending to the ground. It is possible also, that, with the family character of each house, there might be combined the advantages provided in the "mansions," of having a lift for the upper stories, of having one's house kept open and ready for occupation at any time, of meals when wanted from a common kitchen, and of the use, on occasion, of larger apartments in the building, for giving entertainments.

But, while each house might have these additional advantages, it should be self-contained and independent of them. It is probable that the number of houses of this character might be advantageously increased in London, but we are not likely to alter, to any great extent, the old English custom of each house standing on its own ground.

CHAPTER IX.

MATERIALS AND CONSTRUCTION.

IN treating of these subjects I do not propose to give technical details of the bearing-weight of beams, or of the resistance to pressure of different materials. Such information is not within the scope of this book, which does not profess to teach experts, and it could not in any case be given in a corner of a chapter. It can, besides, be readily obtained by those who want it, in the various sets of tables that have been published, giving the results of actual experiment.

But something may usefully be said on the relative advantages of different materials for house-building, and on the methods of combining them so as to secure stable construction; and especially on the artistic effects of colour and surface obtainable by their combination and mode of treatment.

BUILDING MATERIALS.—For building purposes every conceivable material has been used which can be piled or

stuck together so as to enclose space and keep out the weather, or to adorn the surface. All are right in their way; there is nothing common and unclean, if used according to its nature for its proper purpose. Wood, hay, stubble, mud, cow-dung, pitch, lime, cement, bricks, tiles, slates, glass, all manner of stones from granite and marble down to flint and soft chalk, with metals such as iron, lead, zinc, copper, bronze, and even gold, have been used in producing good and true architecture.

The art of architectural construction consists in putting these together to give the shelter and accommodation desired in the house—first, so as to stand; and next, so as to be beautiful in form and in combination of colour.

The most convenient mode of treating the subject will be to take in succession the different parts of a house—the foundation, the walls and openings in them of doors and windows, the floors, the ceilings, and the roof—mentioning the materials suitable for each, and the mode of combining them in construction.

The FOUNDATION is the bed on which the weight of the building rests, and its merit consists in perfect solidity, so as not to yield under pressure. In some cases the ground on the site may be a good natural foundation; in others it may be yielding and uncertain, so that an artificial one is necessary. But no site is so bad that a stable foundation cannot be made on it. Into soft mud piles are driven, which render it consistent, or the building is floated on the top of it on a solid floor of concrete, provided the mud is so enclosed that the pressure from the weight of the building cannot force it out at the sides.

In the sea great stones are dropped in a heap, which settle by the action of the waves into a solid bearing for building on—the method now adopted for the foundation of

piers in the sea under the tide-level, and used, according to the description of Pliny, by the Romans at the port of Ostia. For the foundations of houses no difficulty ever occurs which may not be overcome.

Where the natural one is insecure, the most usual expedient for making a solid foundation under the walls is a bed of concrete, usually two or three feet thick, which is formed of cement and broken bricks or gravel thrown together so as to form a continuous mass, so that, if the building sinks it sinks altogether, and does not crack by one part going while the rest remains firm.

Of natural foundations one of the worst which commonly occurs in house-building is clay, as the moisture is liable to be dried out of it in hot weather, lessening its volume, so that the building gives. Solid rock is of course perfect, though a foundation partly rock and partly of a softer material is unsatisfactory. Gravel is one of the best, as, being pervious to moisture, variations of wet or dryness cause no difference in its bulk.

It is usual on every foundation except rock to widen the walls at the bottom by flat stones, or by spreading out the courses of brick, so as to give them a wider bearing; but I have seen old castles in which the walls were built of the same thickness straight away from the ground, which had stood solidly for six centuries.

It is of the first importance for the healthiness and comfort of a house that no damp should come into it from the foundations. As the material of walls is generally to some extent porous and absorbent of moisture, it is necessary to insert in them, just under the lowest floor a course of non-porous material, such as slate or Caithness pavement, or asphalt, as to prevent the damp rising in them from the ground. If the lowest floor is under the level of the ground outside, means must be taken to prevent the damp getting into the wall above the level of this "damping course," as it

is called, from the damp earth. Sometimes the wall outside is covered with pitch; or loose stones are piled against it up to the ground level, with a drain at the bottom just under the floor-level, to carry off the surface water; or better, an area about six inches wide, with a drain at the bottom, is built all round the house, covered on the top to allow the earth to come up to the walls; or the house may have a wide open area all round, standing in a sort of dry ditch, which is the system usual in town houses. A house in the country looks better rising from the ground, and can be kept perfectly dry even when its floor is under the surface level by making the floor and walls impervious to damp, or by having cellars with openings to the air to keep them ventilated and therefore dry, or by an open space a foot or two high under the floors through which the air passes. It is better always, in order to secure perfect dryness in the lower story, and especially when it is sunk underground, to spread over the whole surface covered by the house a bed of cement or asphalt impervious to moisture, on which the floors of stone or tile or wood are laid. This not only keeps the house dry, but if properly done, so as to allow no crevices or cracks anywhere, has, I know from experience, the effect of absolutely preventing black beetles and other vermin.

Walls.—Mud and stone were probably among the earliest materials used for the construction of houses; but when, as in the countries of Northern Europe, the land was covered with pine forests, the straight logs, laid one above another, were found to form, from the non-conductibility of the material, warm weather-proof walls; and in Norway the houses are still built in this way. The logs are slightly flattened on the upper and under surface, so as to give them a bed. A layer of moss is spread between them, to fill up interstices and keep out the wind; and, to keep the walls level, the thick and thin ends are reversed in each course.

As the damp from the ground decayed the wood in the lower part of the wall, it is often built, for a few feet up, of stones. To prevent the rain coming through, these log walls are sometimes covered with narrow boards, with the edges overlapping. Inside they are finished with a smooth surface of boarding.

When the sea-kings settled in other lands, they carried this method of building with them. An Icelandic chief brought timber from Norway to build his hall, though stone was abundant in the country; and Viollet-le-Duc attributes the wooden construction in the houses of the Middle Ages in France, Germany, and England, to the continuing preference of the northern conquerors for this material.

As these countries, however, did not possess pine forests to supply logs sufficient for building solid walls of wood, a mode of construction more sparing of the material, and better suited to oak and the other woods which they had, was adopted. These were cut into small square posts, which were framed together, forming the skeleton of the house; the spaces between these posts being filled up sometimes by thin walling of stone and occasionally of brick, but more frequently by a surface of plaster on laths outside and inside, forming an air-space between, which keeps out cold and damp (figs. 172 and 173).

The posts, to preserve them, were usually tarred or coloured black, in Germany of tener red (sometimes in France they are neatly covered with slates). The plaster panels between them were white-washed, and sometimes stamped with patterns or painted in colour. Out of those poor materials the art instincts of the people formed a style of building so durable that numberless specimens last to the present day, and so beautiful in its cheery black and white, that it is sometimes still copied purely for the sake of its appearance, forming an outside coating on a house the

Fig. 172. HOUSE NEAR TUNBRIDGE.

real construction of which is of brick. The house at Tunbridge (fig. 172) is a beautiful English example of this mode of construction. Morton Hall, illustrated in Vol. I. (fig. 47, p. 165), is an example not uncommon in England of a large mansion built in this way. The house at Boppart (fig. 173) shows the same mode of building in Germany.

To help to keep the rain off the plaster walls, and to give more space in houses in walled towns where ground is scarce, the stories overhung; the front wall of each being built on the projected floor-joists, which were supported by quaint figures or covered by beautiful mould-

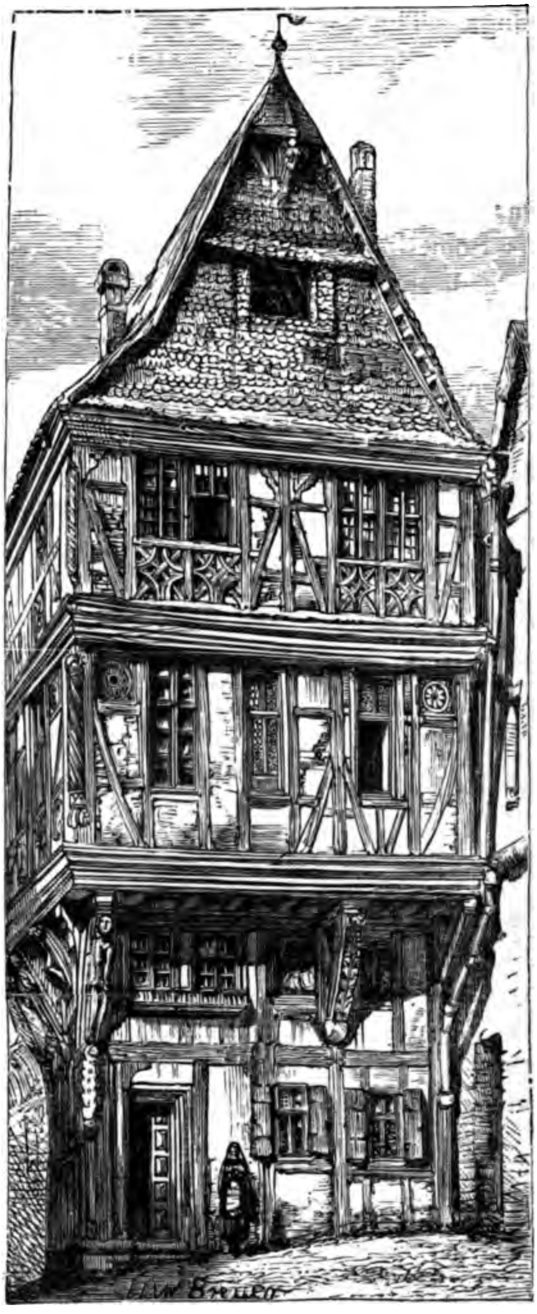


Fig. 173. HOUSE AT BOPPART.

ings. The roofs also projected over the walls, and were ornamented with carved "barge boards" (fig. 172).

The foundation of these houses was usually of stone, to avoid the risk of the posts rotting, from the damp of the ground; sometimes the lower story was altogether of stone, as in the old house at Boppart (fig. 179, p. 190).

Sometimes the intermediate spaces or panels were of wood, these as well as the posts enriched with carving. The house at Hildesheim (fig. 174, p. 165), unhappily now burnt, was a rich and splendid specimen.

This system of *post and pan* houses, as they were called, prevailed all over England during the Middle Ages. London was built in this way till the Great Fire destroyed it, and as municipal regulations compelled the houses to be whitewashed every year, it got the name of the "White Town." These ages were not altogether dark. The clause in the building lease of every London house, that it shall be painted outside every three years is possibly a survival of this regulation.

These houses, however, had the disadvantage of being very combustible. Fires were constantly occurring, and it was enacted that the sheriffs should be provided with a hook for pulling down the houses to stop the fires. One of these hooks attached to a long pole is still kept in a gate-house at Harwich.

The building Acts at present in force in most towns compel a solid wall of stone or brick between each house rising eighteen inches above the roof. To this regulation we are indebted to our immunity from great fires in our modern rows of houses.

This mode of constructing the walls of houses was stopped at last only by stringent laws, which compelled the party-walls between the houses to be of stone. Afterwards the use of wood as a building material for walls was altogether forbidden in our towns.

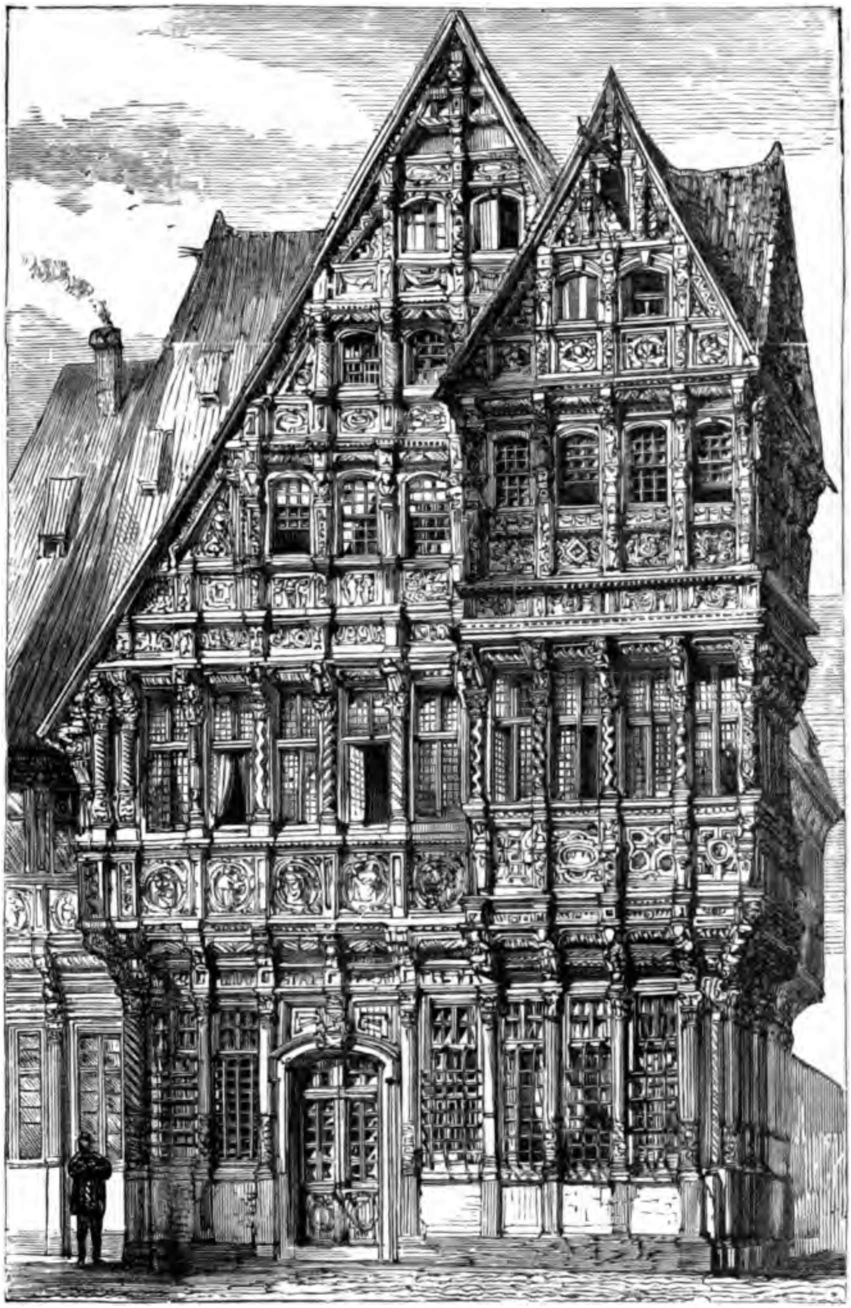


Fig. 174. WOODEN HOUSE AT HILDESHEIM.

It is still a cheap and comfortable mode of construction, which may be used with advantage in country districts for cottages, and for filling in the triangular space of the gables of houses, when, the walls being built to one level height all round, it forms as if a perpendicular piece of roof, with which its construction is more consistent than stone walling.

With the progress of nations in the art of building, stone has generally been substituted for wood—but the details of the wood construction were copied by carving in the stone. Among the most curious instances of this, are those Hindoo "Topes," of part of one of which, that at Amrivati, there is now a reproduction in plaster in the South Kensington Museum. It consists of a railing with gates, round a sacred mound, in which, at enormous cost, long stones represent beams, the nail heads fastening them and the notchings of the carpentry being accurately carved. Even Greek architecture, which is certainly the most refined and finished style the world has seen, bears traces of wooden constructions in its forms, which are perpetuated in a degenerated form after their functions have ceased, like "rudimentary organs" in animals.

STONE WALLS.—Building stones may be roughly divided into three kinds—according to the kind of building which may be made with them.

1st. Those of such consistent substance throughout that they can be cut or hewn into any forms, called generally "freestones," to which class may be added, as capable of being roughly hewn and even carved, granite; and, as the best of the class, white marble.

2nd. Those which can not only be hewn, but polished, like granite and various coloured marbles.

3rd. Those which cannot be cut, but only chipped to a rough surface, such as slates, and igneous rocks, flints, and

pebbles; to which may be added chips and rough blocks of the better kinds of stone.

The first are the best adapted for wall-building, for the best descriptions of which they are cut into square forms with a smooth flat surface, and set in courses of equal height, giving the effect of regularity and order, and of stability and finish, to the wall. These squared stones are usually only an outside skin or coating, the mass of the wall being built of rough irregular stones well packed in lime, or of common bricks.

In ancient architectures great polished stones were one of the chief elements of magnificence, and were valued according to their size, like diamonds: in the temples at Baalbec there are some forty feet long. The Italian Renaissance builders had the same feeling: in the Strozi and Pitti Palaces at Florence there are some about thirty feet long.

PORTLAND STONE.—Long experience seems to prove that in London the best stone to use is Portland. When exposed to the winds, it bleaches to a grey-white more beautiful than marble; and even the thick coating of black, which it accumulates under shelter, seems to give a feeling of rich colour rather than of dirt. The slight decay to which it is subject, in no way affects its stability, and rather improves the mouldings by softening their contours.

MARBLE.—In this country marble is almost never used for the construction of the walls, as it was in Greek buildings (the only well-known example, the Marble Arch, not calling for repetition), and rarely even in thin slabs, for giving them an outside surface or coating, as in those of the Middle Ages in Italy.

It has been a fashion lately to employ polished marbles and granite, usually in the form of shafts and columns, to

ornament the exteriors of our town buildings, but the result has not generally been successful. The dirt adheres to the polished surface as it does to the window-panes, and as we cannot well clean it as we do these, the colour is obliterated and the building soon acquires a dirty appearance. This might be removed by washing, but the process would be inconvenient, and is apparently never resorted to. It is better I think for outside work to use materials whose appearance the dust of our towns does not spoil, such as brick or terra-cotta or Portland stone. Polished marbles and granite are more suitable for the interiors of our buildings where they are less liable to collect dirt, and if they do, are more likely to be kept clean. Sometimes they are used for lining the walls of rooms, such as dining-rooms, from the idea that being non-absorbent the room will keep fresher and risk of permanent smells be avoided. But marble lining in rooms, though it gives an appearance of solidity and magnificence, scarcely accords with our notions of comfort; though it does not make the room any colder, it feels colder than wood or painted surfaces or wall-papers or tapestry when we touch it, in consequence of being a better conductor. It has the advantage of being a permanent material requiring no repair or renewal, unless where gas is burnt, the moisture from which condensing on the surface destroys the polish of some marbles.

In entrance-halls its use accords with our notions and may have a charming effect, but its expense will prevent its general adoption.

RUBBLE-WORK.—Gothic architecture has taught us the possibility of obtaining grandeur with poor materials—small in size and irregular in form. It is often said, with some approach to truth, that in the great cathedrals there is not a stone larger than a man could carry. The builders had not the mechanical appliances necessary for obtaining great

stones out of the quarries, or lifting them on their buildings, and their architecture developed itself in forms which did not require them.

For our houses, especially in the country, excellent walls may be built of rubble-work, or rough and irregular materials fitted together, which not only give a homely appearance, but form a better surface than a finely polished one for nature's colouring of mosses and lichens and creeping plants. Such walling may be built of freestone in irregular shapes as it happens to break, and it also renders possible the employment of other kinds which can only be chipped to an irregular surface.

In rubble-work, however, some pains should be taken that the lime in the joints is not plastered over the surface of the stones in a slovenly manner, else we feel that it would be better to cover the whole wall with a coat of rough-cast, as was frequently done.

The FLINT WALLS used in the chalk districts since the Middle Ages are an instance of excellent work with indifferent materials. The better kinds are formed of half flints, showing the broken surface, which makes a tolerably flat, dark-coloured wall. In still finer work, *white* flints are used, and the flints are not only flat on the face, but squared, the surface of the wall being composed of squares of about five inches each. In the Eastern counties the best flint-work is entirely of *black* flint, and the flints are not more than about three inches square. In some cases the joints are so close that one cannot force the point of a knife between them. As a rule the finer the work the *smaller* the flints, and they are picked out for their blackness, so as to contrast with the white stone, when they are used as inlays. In the cheaper sort the flints are used whole, showing their whitish rounded form outside. These flint walls are really concrete walls; when built with good

lime it is almost impossible to destroy them, for they harden into masses of solid rock. For the corners and window openings, when a straight line is required, and in the Middle Ages for tracery and carving, cut freestone was

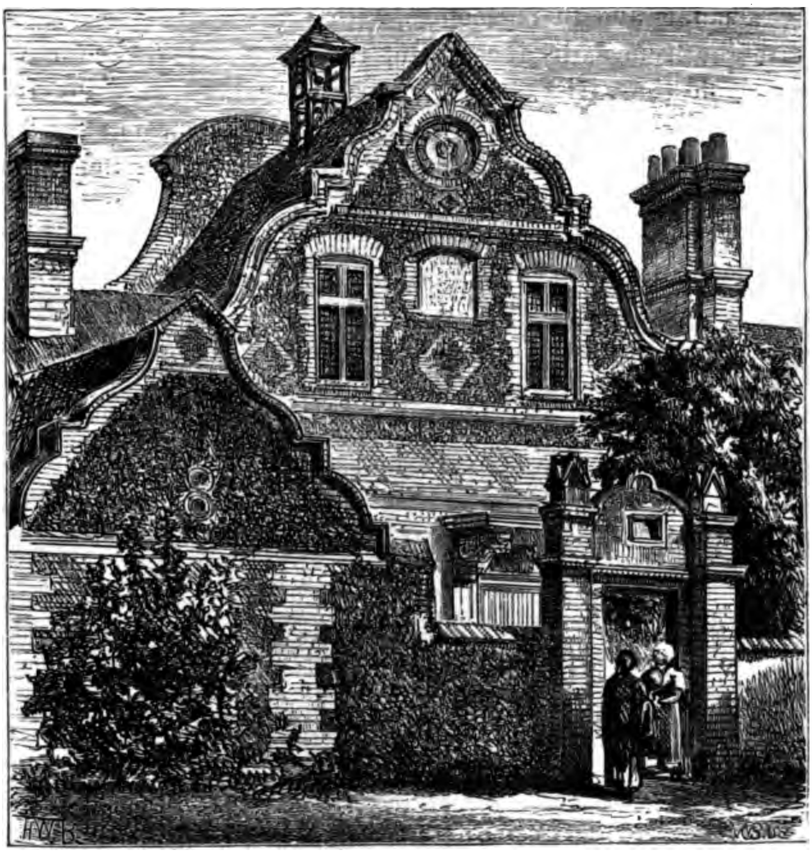


Fig. 175. DRAPERS' ALMSHOUSES, MARGATE.

used. Since the Renaissance such angles have been usually formed by brick, the red colour of which makes a charming contrast with the black or grey flints. The Quaker alms-houses near Margate (fig. 175) are a good specimen of this mode of construction. They have been much injured lately

by some architect, who has attempted to Gothicise them; among other alterations, he has stuck armorial shields over them, which surely have no meaning for Quakers.

As a general rule, a house in the country should be built of the materials of the district, which are more likely to be in keeping and to harmonise with the scenery than those brought from a distance. But these are not always now, as in old times, the cheapest, especially where they involve such tedious labour as dressing flints, for labour has grown dear, and railways and water carriage make the materials of one district available for others.

In towns rough materials are unsuitable. Instead of gathering moss and giving a hold to climbing plants, they merely gather dirt. Those Gothic churches and schools of rough Kentish rag in London and other smoky towns, are absurd and opposed to the practice of the old Gothic builders, who took pains in their important buildings, in towns especially, to square and smooth the stones. In our town buildings we look for greater handsomeness and solidity of work, and more regular ordering of the stones than beside the natural irregularity of the country.

Dry Walls.—Next to standing firmly, the most essential quality in a wall is that it keep out damp. A wall of freestone though it absorbs some moisture, rarely absorbs enough to let the moisture through it, and is safer in this respect than one of hard non-porous stone, in which the damp is sucked in through the joints. Mere thickness will not keep such a wall dry, on the principle that if you give a whole sugar-loaf enough water, it will absorb it as a small lump does. In a castle lately built in Ireland, walls six feet thick were found to let the damp through them, and probably may never dry. The damp must either be kept from getting into them at all, by a coating of cement or rough-cast, or by laying the stones so that the

rain drops from their outer surface as off a shaggy coat; or a hollow space must be left in them, so that it cannot come to the inside. Such a hollow space has also the advantage that it keeps the house cooler in the summer, and warmer in the winter, by enclosing in the walls a layer of air which acts as a non-conductor.

But such outer and inner walls must not be tied together by absorbent bricks or stones, which would concentrate the moisture on the inner wall at the spots where they occur. The inner wall is usually only half a brick thick, so as to leave the wall as thick as possible outside the air-space.

One of the most effective modes of forming these inner linings is "battening" the walls. Wooden pegs are driven at intervals into the joints of the brick or stone, to which straps of wood are nailed. These form bearers for nailing laths to, which hold a coat of plaster separated from the wall by an air-space the thickness of the straps.

The disadvantage of this system is that the air-space so formed makes an excellent harbour for rats and mice, the rough plaster giving them good foothold; and even when they do not come into the rooms, we may hear them careering through it. Nor has it the solidity desirable in good building.

Tapestry was formerly used for the same purpose, and more recently *paper-hangings*—not, as we understand them now, *pasted* on the wall, but literally hung or stretched on canvas an inch or two from it.

On account of its solidity and its setting vermin at defiance, brick lining is preferable if we secure it from damp.

These expedients for keeping damp out of walls will be needless if we can make them absolutely non-porous. Walls of cement concrete, which will be spoken of afterwards, satisfy this condition.

There is another expedient for making walls impervious to moisture which has been successfully employed for those

in a sunk story under the level of the ground. A brick wall is built with a hollow space in it of one or two inches wide. Into this space liquid asphalt is poured, which completely fills it up, and hardening, makes a layer of substances absolutely impervious to moisture. This layer is better formed towards the outside of the wall. It must be uninterrupted by the bricks, as these would be apt to draw damp or to break the continuity and give a chance of leakage. The system is used only for walls underground, and for these it has the advantage over the expedients above described that it requires no drainage, the floor and walls underground forming a water-tight caisson.

Brick.—In most parts of England the common material for building walls is now brick, or small squares of pressed clay of a size small enough to be burnt hard in a kiln. The bricks used in Nineveh and ancient Egypt were, as we know, merely dried in the sun, and their buildings have in consequence, in the course of centuries, become mere mounds of clay. To build a good house, the bricks should be impervious to moisture, else the wet will soak into the walls, keeping the chimneys damp and preventing their draughting, and turning the house into a refrigerator as it evaporates. Before selecting the bricks for a house, especially the facing bricks, they should be tested as to the amount of water they will absorb, which is easily done by weighing some specimens before and after soaking. Some kinds will absorb nearly their own weight of water.

Brick was employed by the Romans in this country; but it seems to have been almost entirely given up during the Middle Ages, though common in the Gothic buildings of Italy and the Low Countries. In Henry VII.'s time it was again extensively used, and when municipal regulations forbade the use of wood for walls, it became the ordinary material for town houses. In some respects it is superior

to stone, being lighter, generally cheaper, more easily built, and making a stronger wall than a stone one of the same thickness. When well burnt, it is absolutely lasting, and presents a neat and regular surface which does not accumulate dirt.

Roman bricks were made very thin—more like large flat tiles in form, and were consequently well burnt. The lime joints are usually as thick as the bricks, producing a picturesque and pleasing continuous surface; an effect, however, not intended by the builders, as such brick walls were originally faced with stucco, stone, or marble. The common size in this country is nine inches long by four and a half inches broad, so that in building them, two ends occupy the space of one side, with a thickness of two and five-eighth inches, so that in the building, every two courses, with their joints, rise six inches.

As the making and laying of the bricks, and not the material, is the chief element of the cost of brick-building, from the tendency at present to have things cheap at any cost of quality or appearance, they are sometimes made thicker. Thicker bricks run the risk of not being so well burnt. They diminish the appearance of size in the wall, and do not produce so good an effect of surface as thinner ones. There is a limit, however, to the size of bricks in this, that they must not be made heavier than the bricklayer can handle easily.

The bricks used in France and the Low Countries are smaller in all their dimensions than ours, and make a more beautiful wall, the individual bricks being lost in one continuous and as if granulated surface.

The ordinary colour which bricks acquire in burning is a yellowish red—brick-red, in fact; a colour beautiful in itself, and harmonising admirably with green landscape; sometimes a little heavy and dull, as in Suffolk bricks, and when used with black joints, as is a fashion at present, producing

a disagreeable purple colour in the wall. Bricks from the same kiln take different tints according to the different degrees of heat to which they have been exposed, some tending to brown, others to orange, from their having been in the centre or the outside of the kiln. When bricks of these various tints are used together in a wall it improves the colour by breaking it, but builders usually, in their desire for what they think perfection, wash the wall over with colouring matter reducing it to a dull uniformity, from which it only recovers after considerable exposure to the weather.

The Tudor bricks, which may be seen in Wolsey's buildings at Hampton Court, were of a rich plum-colour now never produced. Those of the Classic part of the same palace built by Dutch William are of a bright orange red, which forms a gay and charming contrast with the white Portland stone used for the mouldings and cornices and other architectural features.

The common stock bricks made of London clay burn naturally to a brown or buff colour, and when mingled, as we see them in old houses, with red bricks in moulded cornices and round the windows, produce a very pleasing harmony of colour.

But it is now an aim of London builders to banish colour from their walls by using dirty whitish bricks, to make them like what they think is stone-colour. With this view sulphur is burnt with the clay, turning them a yellowish white; or they pick out of the common stocks light-coloured facing bricks of a dull sickly yellow, which are always the softest and worst burnt, and therefore practically the most unsuitable for the purpose. When in addition, as of late years has been their practice, they make the architectural mouldings of grey cement unpainted, the most dismally coloured architecture is produced which probably the world has seen.

It is interesting to trace the origin of this hatred of colour which characterises the common modern London buildings. The builders are perhaps not much to blame; they are merely behind the fashion. In the beginning of the century there was the same hatred of colour among people of taste, and the fashion has now come down to the builders. "Capability Brown," as he was called, who was an authority at the end of the last century in matters of taste, and was employed to produce landscape-gardening effects at many of the noblemen's seats in the country, used to say that "a red brick house puts the whole valley in a fever." Repton, who followed him in the same line, and was also largely patronised by the nobility of his day, calls red brick houses "those modern scarlet sins against good taste." In the exercise of his profession he destroyed the red brick terraces in front of the house at Burleigh, on account, as he says, "of the meanness of the materials."

Gwilt, in his 'Encyclopædia of Architecture,' written in the first half of this century, while compelled with pain to admit that the Greeks in the best ages of their art coloured their buildings, remarks, in explanation of their falling into such a mistake, that "it is by no means uncommon for a person to be fully alive to all the beauties of form, without, at the same time, having a due feeling or perception of the beauty resulting from harmony of colouring. It is therefore not to be assumed that the Greeks, though given to a practice which we would now discourage, possessed not that taste in other respects which has worthily received the admiration of posterity."

In those days when "chaste" was the word which expressed all excellence in art, the builders, being behind the age, stuck to the old fashion of red bricks, till in time the newer one of abolishing colours has come down to them. One cannot avoid a slight feeling of horror at the possible

results when the taste for coloured architecture, which seems rising, shall in like manner descend to them; for colours, like edged tools, are dangerous in the hands of those who don't know how to use them.

In the French brick houses of the sixteenth century a very pretty effect of wall-decoration is produced by forming simple patterns on the walls with bricks of different colours—usually merely a diagonal diaper with lines of darker bricks. The Romans, although they generally covered their brick walls with stucco, sometimes used bricks of different colours for producing architectural effect; employing deeper-coloured bricks for the pilasters and mouldings, those of the rest of the building being pale red—a method similar to that common in old English practice. When colour is attempted it is always safer to employ shades of the same colour rather than a contrast of different ones.

An effect of richness may be given to walls by using bricks stamped on the surface with patterns. Mr. Ruskin gives, in his 'Stones of Venice,' some very beautiful examples of this mode of decoration from Italian Gothic buildings. Attempts have been lately made to imitate it by London builders, but these have not generally proved successful.

For ornament in building, what are called "cutting bricks" may be used; which are of a granular substance throughout, like rather soft stone, and capable of being cut into delicate forms, or even carved into ornament that will stand the weather reasonably well.

This carving of brick was a characteristic of the Queen Anne architecture, and, as fig. 176 shows, was practised also by the Romans.

A finer surface and greater precision are sometimes given to parts of a building by "gauged" brickwork, which consists in rubbing down each brick to a smooth regular form, so that the joints are as fine as a knife-edge. The

absence of the thicker white joints gives a deeper and richer colour, making an excellent contrast with the ordinary brickwork.

Terra-cotta, or baked earth—properly only the Italian name for brick—is used generally to denote the finer kinds, such as the Italians used, modelled into artistic forms. We owe a debt of gratitude to the South Kensington authorities for reviving this art, in the very creditable examples of it in the new buildings of the Museum and in the Albert Hall. The white colour toned with yellow, which they have obtained, is very beautiful of itself, and harmonises well with red brick; and is more satisfactory than the red terra-cotta usually made, which has often a disagreeable bluish-purple tinge. Such materials, honestly confessing themselves to be artificial, are better than any "artificial stone," which never looks or weathers like real stone, though it may be a useful material in its way, and as good for covering with paint. White fire-clay attempts this imitation in balusters for parapets, and wonderfully ornamented vases for gardens, which, however, gather no moss, and soon look dismally dirty. Sometimes for cheapness these balusters and vases are used to ornament stone buildings, but the result is not generally successful. The fire-clay ornaments, though at first they may be the same colour as the stone and undistinguishable from it, do not

Fig. 176. ROMAN BRICKWORK.

weather in the same way, and the difference in substance and colour soon becomes unpleasantly apparent.

Why attempt to imitate stone, except from a foolish desire to be grander than we really are? It is certainly as legitimate, if there is any advantage in it, to use fire-clay or blocks of concrete formed of sand and loose materials of the shapes required, as it is to use bricks. These may possibly, like bricks, be better suited for some purposes than natural stone; if so, let them stand on their own merits.

CONCRETE WALLS.—Walls are sometimes not built up of separate pieces of bricks or stone, but formed in a single piece. The earliest examples of this mode of construction were probably mud walls—still used in some parts of England—which are cheap, and said to be comfortable and lasting.

Of late years, not only the walls but the whole building has occasionally been formed—it is scarcely correct to say built—with concrete of Portland cement and gravel, in a single piece, as if it had been cut out of one stone. In this kind of construction, boards are placed so as to form a space the thickness of the wall, into which as a mould the liquid concrete is poured, where it solidifies into the proper form. The whole wall is not made thus at once, but in stages two or three feet high at a time. And the concrete is used even for the floors and roof, so that the whole house is as solid as a stone jug.

There is no reason why concrete walls should not be good in art, if treated according to their nature. Left rough as they are formed, with the stones and pebbles appearing in parts, and the marks of the boards which formed the mould for them, they are interesting and picturesque, and if the concrete is good they should not on account of this roughness be less solid or water-tight.

They are usually covered with a coating of smooth cement, which makes them uninteresting-looking. From the permanence of old ideas and a dislike of the unbroken surface which is formed, they are sometimes scored with lines in imitation of stone joints. Some relief might be given to the surface in consistency with the mode of construction, by enforcing the lines of junction of the courses in which it is formed; or the surface, if made smooth, might become a ground for painted decoration, or patterns might be stamped on it. I believe the extremely dismal and unsatisfactory appearance which cement buildings usually have arises, not from any fault in the material, but from the designs being ugly and in bad proportion.

Good cement concrete has many advantages as a material for forming walls. It is strong and impervious to moisture; it is cheaper than brick or stone, especially in districts where gravel can be easily got; the only carriage required is for the cement, which is a small fraction of the bulk.

But, except when stone or brick are exceptionally dear, I doubt the practical advantage of using it for a well-finished house. If it be, say, a third or one-fourth cheaper than brick or stone, the saving on the whole cost of the house will be a much smaller fraction, for the cost of the other tradesmen's work is not lessened. The solidity and hardness of the material may even be a cause of increased cost by rendering alterations difficult. It may be said that there should be no alterations in a building, but, however carefully the plans of a house may have been elaborated, some improvements are sure to suggest themselves in the course of construction, which it would be folly not to take advantage of; and, the house being formed of concrete instead of brick, which is cheaply and easily altered, would render such alterations more difficult. To build a house without any alterations, one must either be omniscient or a fool.

The advantage of cheapness in concrete building is not got unless a number of houses are made on exactly the same pattern. A considerable part of the expense is in making the moulds into which the concrete walls are run. Though these are only rough planks, they have to be cut and fitted for the openings of doors and windows; and, if only used once, there is waste and expense. The full advantage of cheapness in using concrete would be gained in a building such as a rope-walk, or manufacturing shed, where there is continuous repetition of the same forms and no finishings; or in a row of workmen's cottages. In this case it would be well to follow some model which experience has proved satisfactory, or to build a specimen cottage in brick, before multiplying the design.

In concrete buildings the foundation should be perfectly secure. A settlement has more serious consequences than in a building formed of separate stones or of bricks, which has some elasticity and may yield a little without cracking. But a wall of concrete is perfectly rigid, and with inequality of pressure from an imperfect foundation, may crack from bottom to top. The precaution is therefore sometimes taken when such walls are of great length to form them in sections with regular cracks left purposely between them, which are filled up when the different sections have come to their bearings.

Concrete is sometimes used for building, properly so called, by being cast into blocks of which the wall is built as with bricks or stones. Beautiful and satisfactory work is thus produced, but, except where gravel is plentiful, and brick or stone exceptionally dear, there is no advantage in cost or otherwise.

Slabs of concrete a few inches thick, formed in this way, have of late been used for building cottages. They have the advantage of cheapness, and of being impervious to

Fig. 177. HOUSE AT TREVES, FOURTEENTH CENTURY.

damp. The cottages are manufactured in quantities, all to one pattern, the slabs being cast so that they can be easily fitted together.

A few years ago there seemed to be some prospect of concrete being more generally used as a material for houses, but the tendency now seems rather to be to adhere to the time-honoured materials of brick and stone.

Although it is preferable, as giving an effect of solidity, to show the materials of which it is composed on the outside surface of a wall, there is no reason in art, or from the analogy of nature, why it should not have, if there is advantage to be gained by it, a coating or skin of some smoother or better material on the outside as well as on the inside, where we rarely show the bricks or stones of which it is built, but cover them with plaster or wood-paneling. Such an outside coating is often practically useful in keeping out damp, and may be made ornamental.

The Gothic house (fig. 177) is a singular example of this, —a vine tree, modelled on the plaster surface, spreads over the gable.

A coat of lime in the form of rough-cast, or of cement, keeps a porous wall dry, makes the house warmer, and may prevent the chimneys smoking. Slabs of coloured marble, even though merely fixed on the surface by iron pins, as on St. Mark's at Venice, produce a rich and beautiful, but not perfectly satisfactory, effect, as they conceal the construction, which it is the aim of the highest style of decoration to interpret and enforce.

In the interior of a house it is rare that we can leave apparent the material of which the wall is composed. Modern Gothic novices attempting to be perfectly truthful sometimes boldly face this, lining the lobbies of a parsonage with red brick, or in model cottages, leaving the bricks unplastered.

In a mediæval building, such as a church, this making the construction apparent gives an effect of dignity and solidity. But, in a room for living in, it gives an air of discomfort, and the uneven surface catches and shows the dirt. Nor was it an old Gothic practice: the hewn square stones which lined the interior of the walls and the pillars of some old churches were often covered with a thin coat of plaster, to receive the painted decorations. Modern restorers often show their ignorance of old work, by clearing away this mediæval plaster and exposing even rough-built walls which were always intended to be plastered; a flagrant instance being the exquisite church of Heckington, in Lincolnshire, known to every student of Gothic by Bowman and Crowther's excellent illustrations, where, in the inside, the plaster has been removed, and the joints of the rough walling have been brought out strongly by black cement, forming a horrible network over the walls. Brutality in art could hardly go farther.

The outside of the walls of mediæval buildings were frequently covered with plaster or rough-cast, or "harling," as it is called in Scotland, which restorers seem to think it their duty to clear away, with the effect, not unnaturally, of sometimes making the walls damp inside. In old houses in Kent the rough-cast is sometimes ornamented by geometrical patterns formed by scoring the surface while it was soft, and filling in parts of the pattern with pebbles darker in colour than the rough-cast. The old farm-house called Callis Court, near Broadstairs (fig. 178), has, or had (for I have heard it has lately been restored) such patterns remaining on its walls.

In some parts of the country, the walls of the houses are covered with slates, as a preventive against the weather. A common square house so treated is ugly, the roof and walls having the same hard shiny purple colour, with no chance of getting toned and softened by the weather. But

Fig. 178. CALLIS COURT, NEAR BROADSTAIRS.

recesses which the window-openings form in them give a feeling of solidity and comfort.

London builders show great skill in building houses so as to look handsome, with the minimum of bricks. These shake with every gust in a storm, the floors bend, the windows rattle, and the partitions between the houses are so thin that we hear all that our neighbours are doing. They are cheap, no doubt, but the money which has to be spent afterwards in decoration and repairs would have been better spent at first on a few thousand more bricks.

The quiet and comfort of a house depend greatly on the walls being impervious to sound. For this, thick walls are an advantage, though these do not always secure it. An air-space, though good for keeping out cold, rather helps to transmit sound, and carries it sometimes in a curious erratic manner along the walls to distant parts of the house. In one case, where a study was next a servants' stair, I made the wall between them double, and filled the hollow space with sand and fine gravel. This is so far effectual that the noise on the stair is heard much less distinctly than in the room above where the same precaution was not taken. In another case, I lined the thin party-walls of a builder's house with felt under the lath and plaster, which does some good. Sound passes more easily through homogeneous than through non-homogeneous materials. It has been found that a wall composed of hard and soft bricks is more sound-proof than one built wholly of hard bricks.

One frequent cause why the sounds from our neighbours are so well heard in builders' houses is that the floor-joists of each house go into the party-wall, and sometimes actually touch one another. As wood is an excellent conductor of sound, the two houses, as regards sound, are made one, and it is no wonder if the next-door piano sounds as if in our

room. Between two rooms in the same house, such contact ought equally to be avoided.

For the sake of comfort and quietness it is wise not to spare bricks.

OPENINGS IN WALLS.—House architecture must always depend mainly for its effect on the necessary openings of doors and windows. And by the disposition and proportion of these alone, without the aid of ornament or mouldings, beauty and grandeur may be produced.

It is a rule of Gothic architecture, that the ornaments or mouldings round openings should be kept *within* the face of the wall, while in Classic they may be projected beyond its surface. These are not arbitrary dicta, but arise naturally from the principles of construction in each style. Gothic is in its essential principle the development of the arch. It would destroy the meaning of the construction to bring out the face of the arch stones beyond the surface of the wall which it supports. And, from a feeling of harmony in the architecture, the same principle is carried out throughout.

In Italian Gothic the shafts of windows sometimes project beyond the surface of the wall, and support canopies; but this is an effect of the Classic influence which Italian Gothic never threw off, and which we feel to be contrary to the spirit of true Gothic.

In Classic architecture, although in arches the face of the stones is on the same principle kept within the surface of the wall, the openings, when square, as they usually are, are surrounded by a frame of harder material, to protect their edges. These frames are treated as compositions, either as simple rims or architraves, or by setting pillars or pilasters up the sides, carrying an entablature and cornice. The principle of construction is a rational one, and it is in accordance with it that these rims in either form should project beyond the surface of the wall.

London builders make them now of cement or stucco, a meaner and more fragile material than the brick walls, the corners of which it is their intention to ornament and protect; and this display of meanness in attempting magnificence is one of the chief causes of the disgust which their architecture gives us.

From this cause, I believe, arises the difference in principle of the treatment of the openings in Classic architecture and Gothic. Gothic treats the openings as a continuation of the wall by means of tracery and thick stained glass, which reflect the light and continue the surface of the wall. Classic architecture dwells on the contrast between solid and void, and obtains its effects by means of it. The windows therefore are deeply recessed, so as to give as much shadow as possible round them. This is not done without inconvenience in ordinary houses. A great deal of light is lost; the sides of the window outside the glass act like a horse's blinders, allowing one looking out of the window to see only straight forward, and not up and down the street: it also destroys the appearance of thick walls and recessed windows inside, and leaves no room for shutters. In great monumental buildings the effect of shadow which may be obtained by deeply-recessed windows may sometimes be desirable; but, for ordinary dwelling-houses, a more suitable and a more beautiful effect may be gained by treating the windows, not as unenclosed openings without glass, but, as they really are, portions of the enclosure of the rooms—continuations of the surface of the wall. Looking at the window from the outside, we ought to feel that it is not an open hole; and when inside the room, we should be conscious that we are protected from the outside atmosphere. The single sheet of plate glass filling the whole window, may sufficiently keep out the weather; but it is absurd and false in art, and destructive of the feeling of comfort in a room,

to make it as if there were nothing between us and the snow.

It is also dangerous, and has been the cause of serious

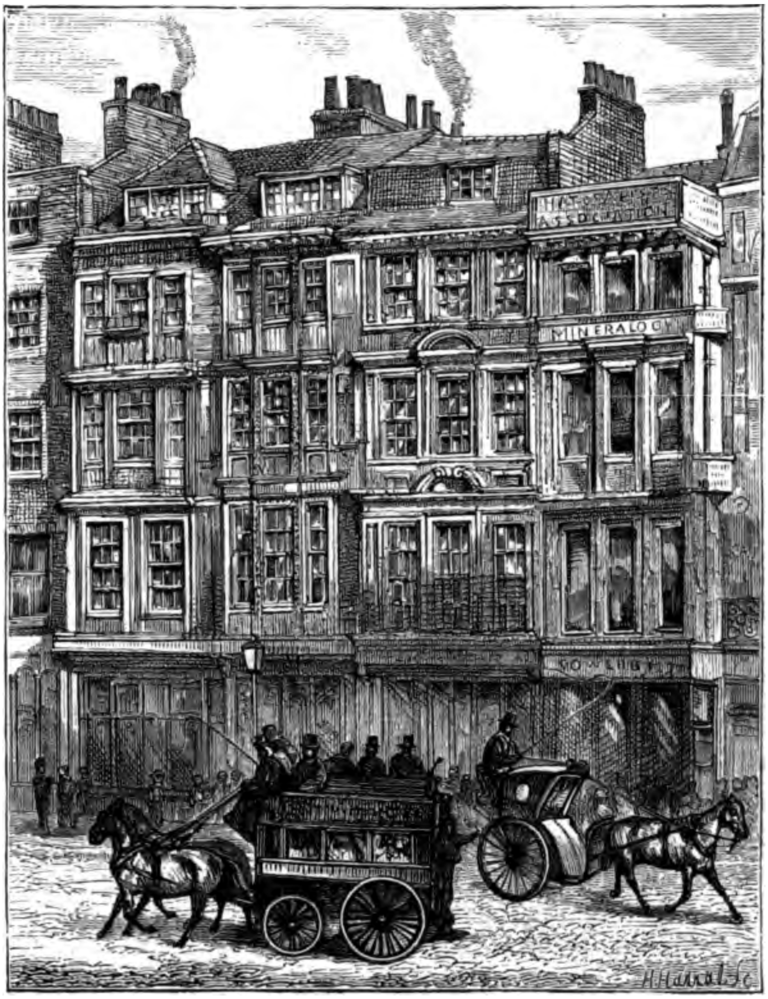


Fig. 181. GROUP OF OLD HOUSES IN THE STRAND.

accidents. In one case a gentleman was killed by walking through a single sheet of plate glass which formed the door

of a conservatory, thinking it was an opening, and being cut by the broken pieces of heavy glass.

In this respect "Queen Anne," though its language is Classic, as shown in its mouldings and ornaments, is Gothic in spirit; the broad window-frames and thick sash-bars, kept flush with the walls, continue the wall surface over the windows.

In this group of old houses in the Strand (fig. 181, p. 195), the architectural effect of the nearest house is ruined by the small panes and sash-bars having been removed, and single sheets of plate glass substituted for them.

Small window panes, however, though they are artistically right, and give an air of comfort both outside and inside, are not likely to become generally popular. They make a house more difficult to design, for the windows must be of such a size as to divide into a certain number of panes of good proportions; while with large sheets of glass, they may be of any dimensions.

The desire for openings and for clearing away obstructions, though inartistic, is characteristic of our time: it will doubtless have its sway, and it rests with architects to find an artistic expression for it. The deception of a window glazed with glass pretending to be a clear opening can never be right. Larger divisions, with fewer and thicker bars, might give the effect of surface, or some slight ornament on the great sheets of glass might make us aware of their existence.

FLOORS.—In this country, the ordinary mode of constructing the floors of a house is by laying joists or pieces of timber about nine inches deep, by about three thick, on edge, from wall to wall of the room. When the stretch is too wide for this, beams are laid across, ten or twelve feet apart, supporting the joists stretched across them. As they dislike their appearance in the room below, builders

usually conceal these beams in the thickness of the floor, notching the joists on to them. But it is better construction to lay the joists over them, allowing the beams to appear in the ceiling below, which they may be made to ornament, instead of disfiguring, if they are properly treated.

Beams are much stronger if instead of being each one piece of solid timber, they consist of two pieces laid on edge with a plate of iron between them, all firmly bolted together. Beams so constructed are called flitch or sandwich beams, the iron plate being like the meat between the two slices of bread in a sandwich.

For longer stretches and heavier weights, iron beams of various kinds are used.

To form the floor, planks about six inches broad are nailed down on the upper side of the joists. When a specially good floor is wanted, the floor planks are made only three inches wide; as there is less room for shrinking in these narrow planks there is less chance of the joints between them opening. Yet if the wood be perfectly dry, narrow floor planks are not a necessity of good building. I have seen in Germany excellent floors, in which some of the planks were between two and three feet wide, which did not appear to have shrunk, as the joints were close.

Sometimes double floors are laid; a rough under layer of flooring carrying the upper one of oak or parqueterie.

FIRE-PROOF FLOORS.—Ordinary floors, as they are formed of wood, and as the mode of their construction allows draughts of air through them, are combustible, notwithstanding that the plaster ceiling and pugging are, to some extent, a precaution against fire. In some houses, therefore, to prevent the risk of fire, the floors have been made "fire-proof."

There are several modes of fire-proof construction in

common use. Sometimes the floors are formed by iron girders, several feet apart, supporting arches of brick or of concrete. Rolled iron joists are laid ten or twelve feet apart; a centring of rough boards is formed between them, on which the liquid concrete is thrown from buckets, and soon hardens into a solid mass. A species of concrete, formed of the plaster of Derbyshire, which has remarkable power of resisting fire, and which for centuries has been used there for the floors of houses, has lately been largely employed. It has the disadvantage, however, of absorbing water.

Sometimes the concrete between the beams, instead of being in the form of an arch, is a flat slab supported by wood or iron framework.

None of these systems of so-called fire-proof construction are really fire-proof, for in all of them the weight is carried by iron beams, which are so far from being fire-proof that if a fire occurs, they almost ensure the destruction of the building.

For if they are made of cast iron, and water from the fire-engines touch them when hot, they crack; if they are rolled joists of malleable iron, when hot, if they stand water they stretch and push out the walls: and if built of iron plates, or especially if formed of iron lattice-work, they contort and twist about under strong heat.

Where the width of the floor does not exceed twelve feet, so that the concrete arch can stretch from wall to wall without the use of iron beams, this construction may be considered perfectly fire-proof. But in most houses the stretches of the beams must be much longer than this. We make our great reception-rooms on the lower floors, with smaller rooms above, and consequently, whether we have concrete or wooden floors, iron beams are necessary to bridge the wide spaces.

As it is the exposure of the iron beams to fire and water,

which make the so-called fire-proof floors so dangerous in fires, a system has been devised for covering them with terra-cotta so as to prevent the fire getting at them. I have no experience of this system, but the principle seems reasonable. A covering of plaster over all the iron construction of a building has been proved to be a very considerable protection against its injury by fire.

Wooden beams bearing the concrete, as in Hatfield Hall, are probably safer than iron; for a wooden beam burns with difficulty, may bear its load when half charred away, and has not the dangerous character of iron, which makes it impossible for the fireman to trust it in a fire.

As wood is really more fire-resisting than iron, it has been proposed to make floors fire-proof by forming them of solid beams of wood, laid close together. I have no experience of the result.

Though experience lately has shown that the so-called fire-proof floors have not served their purpose in warehouses filled with combustible materials, they may, notwithstanding, render a dwelling-house practically fire-proof; since, being constructed altogether of non-combustible materials, there is nothing in the house to burn.

Independently of this they are worth their cost in making a better house. If the iron joists are rigid, which depends more on their depth than on the quantity of material in them, each floor is as solid as a rock, the house never trembles or shakes, and such floors help materially in preventing the transmission of sound between the stories.

They are, therefore, most suitable for buildings in which each floor is occupied by a separate family, forming a solid partition wall between neighbours above and below, like that separating them on either side.

The upper surface of such floors is often finished in the same material; or they may be covered with scagliola or mosaic, like those of Italy; or they may form an excellent

foundation for tiles. But in this climate such materials are cold, and do not accord with our notions of comfort. They may suit individual taste, and by thick carpets actual discomfort might be avoided, but they would not generally be liked and would therefore injure the marketable value of a house; accordingly, whenever I have used such concrete floors, I have covered them with ordinary wood boarding.

Ceilings.—On the under side of the joists, thin laths of wood are nailed for supporting the plaster ceiling of the room below. These laths are kept about a quarter of an inch apart to allow the plaster, thrown smartly on them with a trowel, to pass between and to spread over the upper sides of the laths, giving it a hold or "key," as it is called. In old ceilings, or with bad plaster under springy floors, pieces of the ceiling sometimes come down from this "key" getting detached from the plaster underneath.

The plaster in the old Jacobean buildings is sometimes so good that even when detached from the laths it bags like a piece of cloth in parts, without breaking.

In some old buildings there is no ceiling under the joists which are planed or "dressed," as it is called, as are also the floor boards on their under sides to form the visible ceiling. This system has the disadvantage that every sound in the room above is heard below.

And scarcely better in this respect is the system employed in some modern Gothic houses of nailing planks, stained and varnished, to the under side of the joists, to form a wooden ceiling, for it gives only wood between the rooms, above and below, which is an excellent conductor of sound.

Even a ceiling of plaster, though it is better than wood as a non-conductor of sound, is not sufficient; and means must be taken to "deafen" the floor, as it is called. This is usually done by what in England is called "pugging." On fillets nailed on each side of the joists, rough boards are laid

and over these is spread a coating of rough plaster. This has the advantage of checking the burning of the floors if the house catches fire. Sometimes, also, the vacant space between the joists is filled in with loose material, such as sawdust or cinders. When this is done, the joists must be made stronger, as this filling-in adds considerably to the weight they have to carry.

But none of these expedients prevents the contact of the floor-boards with the joists and, therefore, the transmission of sound to the ceiling below. This contact is prevented, and the transmission of sound to the floor below to a great extent lessened, by laying a strip of thick felt along the top of each joist.

This, however, gives rise to a difficulty in nailing the floors, as, in knocking the floor-boards together, the felt is nipped up between them, and prevents the boards coming close together. I find this can be obviated by keeping the felt down by a lath of wood nailed on the top of it, over which the boards slip together easily.

The best mode of preventing the transmission of sound between the different parts of buildings is a subject well worth the attention of architects and men of science. So far as I know, it seems best attained by forming the floors or walls of materials which are not homogeneous.

THE ROOF.—On the treatment of the roof of a house depends, in a great measure, its character and appearance. It makes with the chimneys the sky-line, which cut out in dark against the light sky, is the most conspicuous line in a building, and the effect which the house will have in the landscape is mainly determined by it.

The late Gothic movement had a marked effect on the forms of roof in this country. The roofs in the best periods of mediæval Gothic were steep, and in modern Gothic they must therefore be steep also. As the style is

a rational one, governed only by considerations of reason and convenience, a reason for the use was invented. It was said that though flat roofs might be suitable in the South, steep ones were a necessity of our Northern climate, with its rain and snow.

The question, however, is not one of climate or convenience, but of taste, and has always been, and always will be, determined by the preference, conscious or unconscious, in the minds of the builders for horizontal or perpendicular lines. The climate of Switzerland is quite as bad as ours, but the roofs there are generally low pitched, a tradition probably from its Roman conquerors. In this country, too, as elsewhere, the Roman roofs were low pitched, and covered with tiles of the usual Italian form, of which we find the remains in their stations.[1]

In the earlier Gothic, in sympathy with the aspiration of the style, the roofs were steep pitched: when in Tudor architecture the pointed arch had disappeared and become flat-headed, the roofs became flat also; so that lead was the only possible covering for them;[2] while in France, where the architecture retained stone vaulting and the pointed arch, the roofs became steeper than ever.

In the common builders' style of last century, the pitch was usually made one in three, just enough to turn the wet. Lately, the tall steep roofs of the French Renaissance have come into fashion again, even in town houses where the sky-

[1] Some tiles of the usual Italian form (fig. 186, p. 208) were found at a Roman station recently discovered at South Shields.

[2] In England, during this period, the roofs of many of the old churches were made flat and covered with lead, partly, I believe, with the view of aiding, by the contrast of a long horizontal line, the towers, which are such a splendid feature of Perpendicular churches. Restorers replaced these flat roofs by pointed ones altering the character of what had been a landmark for centuries, and injuring, too often, the appearance of the building. At the church of the Venerable Bede, at Jarrow, the Perpendicular builders had made the tower, supposed to be Saxon, though really Norman, a striking feature of the landscape, by their flat roof. The new pointed roof has completely swamped it.

line is of little importance, at a great sacrifice of convenience, as builders have complained to me; for they make the chimneys smoke unless the chimney shafts are carried so high that sweeping them becomes almost impossible.

So far, therefore, as our climate is concerned, we may choose any pitch we like for our roofs.

For perfect convenience, the "Mansard" roof, as it is called, from the name of the French Renaissance architect, who is supposed to have invented it, though it existed before his time (fig. 182), A, E, D, G, B, is as good a form as any, for it gives an additional story in the roof, without increasing the height of the walls. Gothic architects, however, and Mr. Fergusson, think it ugly.

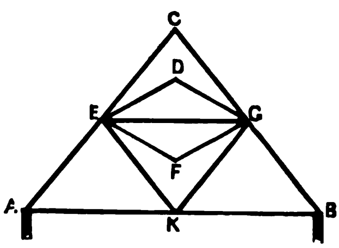


Fig. 182.

This form of roof suits the plan of modern houses, in which several rooms are often included under one roof-span, which may therefore have a stretch of forty or fifty feet. The upper part of the roof being flattened, E, D, G, the roof has not the height and bulk it would have if carried up to a point in the straight line, E, C, G, necessitating enormous height in the chimneys.

Sometimes for such spans a double roof is formed, A, E, F, G, B; this makes an inconvenient central gutter, which sometimes causes a swirl of wind, and injures the draught of the chimneys.

Another mode of treating this form of roof is to finish it as two equal gables, A, E, K, G, B. This has the same disadvantages, with the additional one of lessening greatly the accommodation in the roof.

A very convenient form, practically, is to make the sides of the roof steep, and the centre a lead flat, A, E, G, B:

This was a favourite form in Queen Anne architecture, the lead flat being surrounded by a railing or balusters of wood, which makes at least as good a sky-line as modern iron ridge-cresting. The Custom House at King's Lynn (fig. 183) shows such a railing on its roof. The evils of a centre gutter are avoided, good accommodation is obtained without inordinate height, and the roof is easily accessible for repairs.

Fig. 183. CUSTOM HOUSE, KING'S LYNN.

Perhaps the most inconvenient form, practically, is the steep pitch of modern Gothic. The snow tumbles off it in masses, instead of melting away harmlessly, and it is so dangerous for workmen going on it for repairs that whenever I have used it I felt that I had run a risk of committing manslaughter.

Enthusiasts occasionally suggest that we should make the roofs of our houses in towns flat, like those in the East, and use them as gardens and promenades. But the difficulties outweigh the advantages. Except where land is very dear, the expense of making a water-tight flat roof to

bear traffic is greater almost than buying more land, as has been found in some of the London Board Schools, where the roof has been used as a playground. To cover the flat surface with lead is expensive and unsuitable for traffic, while cement cracks and lets in water if there is the slightest settlement, such as, in a building with an ordinary roof, would be harmless.

Fig. 184. HOUSE AT NUREMBERG NEAR THE TOWN HALL.

On the treatment of the roofs depends in great measure the character and beauty of the building. Here is a house at Nuremberg (fig. 184) a mere square block, of which the architecture could not well be plainer; yet architectural character and interest has been given to it by simply bringing the roof lower down in the centre and spacing the windows so as to give the appearance of two angle towers.

ROOF-COVERINGS.—In this country the only generally practicable roof-coverings are slates, tiles, and lead or zinc, and occasionally copper. Thatch used to be extensively used, not only in the country but in towns, not only for cottages, but sometimes even on churches. It is an excellent roof-covering, warm in winter and cool in

summer, picturesque and homely in appearance. But it has its disadvantages. It requires constant repair and occasional renewal, it gives harbourage for insects and for rats; occasionally in storm the thatched roof was blown off a house. It was used chiefly on account of its cheapness, the material was on the spot and cost nothing, and the labour could always be spared. But labour has become dear, and straw is worth its carriage. Thatched roofs are now a luxury for gentlemen's summer-houses. It gives one a pang to see the picturesque heather thatch on the roofs of Highland cottages replaced by shiny black felt, but the inhabitants doubtless find it an advantage.

Slates are now almost everywhere throughout the country, from the facility of carriage, the cheapest material for roofing. Being light, they require a lighter framework to support them than tiles, and being flatter so that their edges fit close, and impervious to moisture which tiles seldom are completely, they can be laid at a lower pitch.

Unfortunately, though a product of Nature, they are often bad in colour; the worst in this respect being the purple Welsh slates. But perhaps Nature in making them did not anticipate our use of them. Of some kinds the colour is made worse than it need be; those which turn out mottled and varied, and which might break and improve the colour of the roof, being cast aside at the quarries, where the useless fragments form vast rubbish heaps of good material wasted through folly.

Some Welsh slates are fine in colour; but Welsh slates generally are not the best in quality, being frequently thin and brittle. Westmoreland green slates are charming in colour, being a pale sea green, which goes well with red brick and against the sky (some Welsh slates resemble them in this) and they last admirably. They are dear, however, and difficult to get, the quarries being insufficient for the demand. Lancashire slates are excellent in

quality and of large size, but rather uninteresting in colour.

The Scotch slates are usually small and thick, and make a durable shaggy-looking roof, dark in colour. In France the slates are exceedingly thin but durable, and they make a beautifully smooth and regular roof. They can be cut nicely and have therefore lent themselves to the minute and fantastic forms of roofing of the French Renaissance, and in France and on the Rhine they have influenced, as we have seen, the forms of the architecture.

A charming and picturesque roof-covering are those great slabs of stone which we still see sometimes on old buildings, giving even mean buildings a dignified appearance. But they are impracticable now; they are heavy and require an expensive framework to carry their weight; they do not last as well as slates or tiles, and not being quarried now for roofing purposes, they are difficult to get. Several of the old colleges at Oxford are roofed with small stone slates, which helped to produce the beautiful grey look of old Oxford. In some cases these have been replaced by ordinary slates.

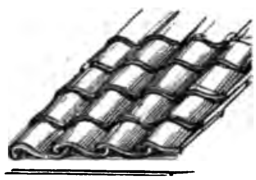


Fig. 185.

The characteristic roof-covering of England is the plain flat red tile. They are better in colour than most slates and are a better protection against the weather. Being thicker and of more substance, they are warmer in winter, while in summer their red colour reflects the red-hot rays of the sun and keeps the house cool. It is not considered safe to lay them to a lower pitch than a right angle; though a less pitch is occasionally risked without harm.

I cannot share the prevalent dislike to the common old red pantiles (fig. 185) which used to be universally used for cheap work and are therefore thought vulgar. Yet their curve is almost the same as that of a favourite Greek

ornament. They are certainly more beautiful than some fantastic forms of recent invention (e. g. those on the new Dulwich Schools), but they work best on an unbroken stretch of roof and therefore do not fit well with the modern fashion of dormers, and in some places where formerly they were the only roof-covering, they have now almost ceased to be made. Pantiles make substantial and water-tight roofs, but they require good and careful work, which is not always to be got, and the association of cheapness, and therefore of meanness, connected with them, prevents them being used on good houses. They can be laid to a lower pitch than plain tiles. A pretty effect is produced in some old English houses with Mansard roofs, by the lower steep part being covered with plain tiles and the flatter part above with pantiles.

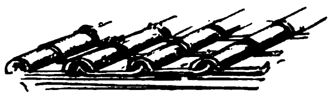


Fig. 186.

The old Greek tiles (fig. 186) are also beautiful in form; they are still commonly used in the South of Europe. Remains found in Roman stations prove that they were used by the Romans in their buildings in this country. In this mode of tiling, large flat tiles are laid side by side, the edges at each side being turned up to make a channel for the water. Over these edges where they come together is placed a semi-cylinder, which keeps the water from getting in between the tiles. The common pantile is formed on the same principle, only the flat and the round part in it are made in one piece. But the Greek tiles have not the same mean associations, and therefore we may use them without offence or question. They can with safety be laid at a very flat pitch.

Fig. 187.

In Germany, roofs used to be covered with tiles of the form of half cylinders, the lower layer a series of

runnels for the water, the junctions of the edges being covered with a similar tile turned the other way (fig. 187). Some of the old towers on the walls of Nuremberg (figs. 188, 189) are roofed in this manner. It makes a rather heavy roof, and is now out of fashion.

The old English plain tiles have not the disadvantages which have made pantiles unfashionable. They cost more and their associations are with old Gothic. An old tile roof, with the red broken by the exquisite grey and green

Fig. 188.

Fig. 189.

TOWERS ON WALLS AT NUREMBERG.

of lichen and moss, is one of the loveliest pieces of colour in architecture. But to produce this needs time and a purer atmosphere than is usually found in our towns, for lichens are of all plants the soonest destroyed by smoke.

But tiles look well even in our towns: they brighten their dinginess, and if they do get black, black and red make a good contrast of colour. The soot is quite sufficient for the purpose, and the colour is all the better for the black being laid on irregularly. It is quite unnecessary in London, as is sometimes done, to mix bands of black tiles

in the roofs, or of black bricks in the walls, to get this contrast of colour.

Tiles improve in quality as well as in colour with age and moss. Their pores get filled up and they become a better weather covering. A tile is best when completely non-porous, but some clays, if burnt hard enough for this, turn black and slimy-looking from becoming vitrified, while if burnt only enough to make them red, they are so absorbent that the roof will suck up the whole of a heavy shower without a drop going into the gutter, which seriously

Fig. 190. TOWER ON WALLS AT NUREMBERG.

increases the weight of the roof, and, by the evaporation afterwards, turns the house into a refrigerator. The porosity of tiles should be tested before they are selected for a roof. This is easily done as with bricks, by weighing them when quite dry, soaking them for a day in water, and then weighing them again, to see how much they have absorbed. Some tiles will absorb almost their own weight of water.

Tiles of a good red colour can be got of excellent quality and almost non-absorbent.

Sometimes roofing tiles, instead of being square at the

bottom, so as to form when laid side by side a straight horizontal line as in slate roofs, are each pointed, forming an ornamental jagged line; or rounded like a fish's scales, which gives a pretty effect and would be pleasing were it not that our architecture lately has trusted too much for its effect to such little prettinesses.

The glory of a plain tile roof is that its mass of quiet beautiful colour gives dignity to the worst and most fantastic architecture. Like Charity, it covers a multitude of sins.

CHAPTER X.

HEATING.

WE have now to consider all the arrangements of a house whose working depends on motive power of any kind—such as heating and flues, ventilation, lighting, hot and cold water supply, drains, bells, speaking-tubes, and lifts.

On the proper arrangement of these things, the comfort of a house in a great measure depends. They should not be complicated, requiring skill or knowledge for their management, which cannot be looked for in ordinary servants, else they will go wrong and become useless, or even a source of danger, but should as far as possible be simple and self-acting.

HEATING.—For heating English houses the best system, on the whole, is the old one of open fires. No doubt it is unscientific: it produces dust, which by other systems might be avoided; and it is wasteful, as a fraction of the fuel in a close fire would produce the same heat in the

room which in an open fire goes mostly up the chimney. But it has the advantage that we are used to it, and that very one understands it: it is a tolerably efficient mode of ventilation, and it is so cheery and pleasant that we are not likely to abandon it, as long as the coal lasts.

In some old English halls the fire was burnt in the centre of the floor. In the hall of Westminster School a fireplace of this kind continued till the present generation. The use of the louvred turret, which still remains on the roofs of many halls, was to let out the smoke. This practice did not arise from ignorance of the use of chimneys—we find these in the earliest houses—but was adopted in order to give more efficient heating. A greater number could gather round the fire, the heat was not wasted up the chimney, as it is with a fire in a fireplace, but the whole of it went to heat the hall. The smoke was no doubt an inconvenience, but the smoke from wood, which was the common fuel, has not the dirt and disagreeableness of coal smoke, and, with a bright fire, would rise above the head to the roof, where the open louvre provided an exit for it.

The great open fireplace, wide enough for seats inside it, on each side of the fire, from which you can see the sky up the wide chimney—with the logs burning on the fire-dogs—was not an efficient mode of heating. Even sitting close to the fire, while one's face is scorched, one's back gets cold from the tremendous draught up the chimney; but while the forests lasted, and logs could be got for burning, these chimneys served their purpose well. They secured freshness and ventilation, and the people were hardy and could stand draughts and changes of temperature. In appearance they are the most charming of all fireplaces—the ideal of an English hearth.

FIRE GRATES.—When the forests were exhausted, the

wood fire on the hearth was found to be impracticable, and coal had to be used.

The dogs or andirons for supporting the logs, and letting the air under them to make them burn, were replaced by an iron basket for burning coal in, with an open grating or "grate" at the bottom to give a supply of air. In later times, with the view of giving more heat or from mere change of fashion, the open fireplaces were sometimes built up and close grates adopted.

The modern Gothic revival has caused a return again to the old open fireplace, with a basket grate standing loose in it. Such grates are called "dog-grates," from having at the sides imitations of the "dogs" which supported the logs in the old wood fires. Modern open fireplaces are generally modified in some respects from the ancient ones. They are smaller, just large enough to hold the grate, only in rare instances with room for seats at the side. The sides of the opening are lined with glazed tiles which glance in the fire-light and reflect the heat into the room; they should be built at such an angle as to do this effectually. They are frequently made at right angles to the wall, and heat is lost by being merely reflected back into the fire and going up the chimney. The back of the fireplace opening may be built in fire-bricks, or have an ornamental cast-iron back fixed against it; recastings from old ones are now frequently used. It ought not to be lined with tiles, as they get blackened with smoke and fall off from the heat to which they are exposed.

Such a fireplace, with glazed tile sides as reflectors, heats a room very efficiently; but before adopting it we must be sure that the chimney draws well; for the smoke, instead of being guided by the sides of the grate to the entrance of the flue, has to travel across a wide open space, and in its course is apt to be blown out into the room. The chimney opening, too, is wider than is usual in

ordinary modern grates, and requires more air to supply it, which, in a well-built house with tightly-fitting doors and windows, it does not always get. Not only are our houses more air-proof, but we have a much greater number of fireplaces in the same space than in old houses. These had a few rooms of large size. We have a number of small ones, each with its fireplace, all requiring a supply of air. In several instances I have known open fireplaces cured of smoking by making small openings, either over the door into the hall, or by a ventilator to the open air, giving the flue a supply of air.

The "dog-grates" in open fireplaces should have fire-clay backs. Fire-clay being non-conducting, retains the heat and radiates it into the room, and also keeps the coals in a glow. A fire, surrounded by iron which conducts the heat away from it, is apt to go out unless it is constantly stirred. It is well also to have fire-clay sides, and I believe a fire-clay bottom also would give more heat, and would aid in thoroughly burning the coal.

I think we might still have in some cases the old open fireplaces, eight or ten feet wide, with seats in them and a window to look out at. We need not have the chimney as large as in the old ones—we can dispense with the view of the sky up it—and the fire might even be contrived to burn without inconvenience on the hearth.

Hob grates came lately into fashion again with the "Queen Anne" movement. I remember the protest against them of a manufacturer, who made one for me about twelve years ago, as he was removing them from old houses every day. He now supplies quantities of new ones cast from old patterns. In my experience they are an inefficient kind of grate, giving out little heat and liable to smoke. This may generally be cured, by lessening the width of the opening above the hobs, so that the smoke is guided up

to the opening of the flue. In fact, the less amount of hob the better the fire draws.

The grate which superseded hob grates, and is still in common use, has an iron front filling the fireplace opening, in which is an arched opening for the fire, diminishing (by means of sloping sides so as to reflect the heat) to a smaller arched opening into the flue right behind the fire, provided with an iron door, by closing or opening which the draught can be regulated. These grates are more efficient than hob grates, though in them much heat is lost by the strong draught into the opening immediately behind the fire, drawing the heat and even the flames up the chimney. The fire-box has now usually a fire-clay back. The grate should be set in solid brickwork, which accumulates the heat of the fire and radiates it out into the room.[1]

A very efficient kind of grate, usually in Scotland called the Kinnaird grate, is made by the common front bars and bottom grating set in fire-clay sides and back. The front filling up the chimney-piece opening may be of iron or polished steel; but these grates are now frequently made with only a narrow rim of iron or brass round the fire, the rest of the chimney-piece opening being filled up with ornamental tiles.

Grates are so called from the open grating forming the bottom of the fire-box, which was introduced as an improvement on the old system of burning the fire on the hearth when wood fires were given up and coal came into use. These open bottoms have the effect of making the fire burn brighter, by allowing a free passage of air to it. They produce the same effect as the "dogs," on which the logs

[1] In Scotland grates are not usually built in, but are set loose in the chimney-opening, much of the heat being thereby lost. They are regarded as furniture, not as the fixtures of a house; a family, on removing from one house to another, takes the grates with them. It would be as sensible to take the chimney-pieces. It seems strange that this absurd practice, which benefits no one but the ironmongers, should not be altered.

were set in the old wood fires, to allow the air to get all round them. But of late their efficiency has been doubted, and a return to close bottom grates, and even to burning the fire on the hearth, has been advocated. The open bottom, though it makes a brighter fire, is wasteful, for it creates a strong draught which carries the heat up the chimney. The air admitted at the bottom cools the fire, so that unless constantly stirred it goes out, and the cinders are never thoroughly burnt.

A fire on a solid fire-clay bottom burns dull, especially at first, but burns long; for the bottom getting hot prevents the fire cooling and burns the cinders to ashes, while the mass of fire-clay radiates great heat in proportion to the coals burnt.

In some cases even front bars are dispensed with, and the fire burnt on a fire-clay hearth as it was before grates were invented: with this difference, that the fireplace opening is not wide like the old ones, but contracted to the size of an ordinary grate. I know from experience that all these kinds of grates and fireplaces are practical and efficient.

HEATING BY HOT AIR.—Open fires in all these forms are wasteful. A great part of the heat goes up the chimney, and is lost in warming the external atmosphere.

By other methods about twice or thrice as much heat could be obtained from the same amount of fuel; but for ordinary dwelling-rooms no other method has been found so pleasant and satisfactory or so healthy; and, notwithstanding that the wastefulness of the system has been demonstrated again and again, our houses are likely to continue to be built with a fireplace in each room. But for public halls and churches, for passages and large rooms in dwelling-houses, the amount of heat which can be got from ordinary open fireplaces, however large, is insufficient

to warm them, and some other expedient must be resorted to. A town house, wedged in between its neighbours, and heated by these fires, is easily warmed; but in a country house, open on all sides, it is difficult to keep up a comfortable temperature throughout without some general system of heating. A common method of warming large buildings has been by hot air. Air, when heated, becomes lighter and rises, and, by the motion thus imparted to it, can be diffused through a large room or led about a building.

This system has the advantage, besides heating the house, of supplying it with fresh air; for, when properly carried out, air from outside is led in, to be heated and diffused.

In American houses and hotels there is one fire for the whole building for heating air, which is led by ducts in the walls and pipes to each room, where it enters by a grating which can be opened or closed at the pleasure of the occupant. The dust of open fires, and the trouble of making them and of cleaning grates, is avoided.

Our adherence to old customs has never permitted us to carry out to this extent the system of heating our houses by hot air. We have contented ourselves with using a general system of heating in houses as a supplement merely to open fires. Many English people cannot bear the American mode of heating, and prefer to shut the hot air inlet into the room and keep themselves warm by putting on more clothing.

But even the comparatively low temperature of the heated air in English houses is to some people unbearable. It makes them feel enervated and listless. In America, where the evil has been greatest, the system of heating our bodies and our rooms by the air which we have to breathe has begun to be questioned, and by some Americans has been denounced in strong terms. The air supplied to the rooms is sometimes heated to 100° or more. Mr. Leeds, in a Treatise on Ventilation published at New York, declares

that this heated air "is the great curse of the American people. It is that dry lifeless, withering, debilitating, poisoned stuff with which most of our best houses and public buildings, and, most unfortunately, many of our school-houses too, are filled and warmed, and which is filling our systems and warming and drying the life and substance out of about two-thirds of the people of this country."[1]

The system of warming our houses by the air we breathe is not natural. The heat of the sun passes through the air without warming it. Its rays pass unimpeded through the atmosphere and warm the earth. Air is heated only by coming in contact with heated bodies. The system of Nature is that our bodies are kept warm by the sun's rays, while we have cool air to breathe. The exceptions prove the rule. The hot winds of Africa and Australia, heated by passing over burning deserts, are oppressive and debilitating. We imitate this when we heat our houses by hot air. Cool air to breathe is bracing and invigorating. We can breathe without harm, as Arctic voyages show, air many degrees below zero, provided our bodies are kept warm.

It is a common but erroneous idea that heating the air deprives it of its moisture. It deprives it of nothing. But air, as it becomes heated, acquires a capacity for imbibing moisture, which the Scotch call "drouth." Heated air, therefore, except in exceptional circumstances when it cannot obtain it, contains a greater proportion of moisture than cold air. Heating it by stoves, therefore, especially when it is overheated, renders it unnaturally dry for warm air, and makes it unsuitable for breathing.

The rays from an open fire have the same action as those of the sun—they pass through the air in the room without heating it, to our bodies or the walls and furniture, and thus, while keeping us warm, leave us cool air to breathe.

[1] In some parts of America the old custom of open fires is still adhered to.

The air in a room with an open fire, if not renewed, will in time get warm by contact with our bodies and the walls and furniture; but it is not a source of heat; it does not warm us any more than a chair or table does, nor does it get heated by the fire, for the air which comes in contact with the fire and its surroundings is carried off up the chimney. The open fire is therefore a scientific and natural mode of heating, which heated air is not.

A heated mass of metal, or a German stove, or hot-water pipes, radiate heat in the same way as an open fire, heating only the air which comes in contact with them; but as this heated air rises, setting the air of the room in motion and bringing it into contact with the heating surface, the air enclosed in the room will in time all become heated and stifling to breathe. But for this, such hot bodies would have the same effect—of radiating heat without warming the air—as an open fire. Such heating is cheaper than open fires, free from dust, and can be used in positions where open fires are impossible. It is of importance, therefore, to consider whether such heated bodies can be used as radiators without overwarming the air in the room. To effect this, the air must be carried off from the room before it gets too hot for breathing, as it is by the open fire. This is a question of ventilation, and will be considered under that head. We may conclude from the teaching of nature, and the experience in this country and America, that heating houses by hot air which we have to breathe is unnatural, unwholesome, and disagreeable. To make the air hot enough to be the sole means of heating spoils it for breathing; but a supply of moderately-heated air is of great advantage to a house, not merely in warming it, but still more in ventilating it, and if fresh and only moderately warmed, up to about 60°, produces no stifling effect.

It is an easy matter to heat a building if we are careless

about its ventilation. All that is wanted is a stove, or hot pipes, or flues, radiating heat, and warming the air which remains in the apartment. This is the principle of German and Russian stoves, and of the hot-water pipes which we lead about our houses. It is easy also to ventilate a building if we are willing to lose heat, and to endure cold draughts.

But neither of these systems solves the problem. The first makes a close and stifling atmosphere; the second gives people colds, and, whatever the advocates of ventilation may say, the ordinary opinion that catching cold is a more serious injury to the health than enduring, for a few hours, a close atmosphere, is founded on wide human experience. The bad air may give one headache for a day, but a cold usually lays one up for a week or two, and sometimes sows the seeds of permanent disease. Unquestionably, however, the habitual living in a vitiated atmosphere, lowers the vitality, and renders us more liable to cold; yet people seem to stand a vitiated atmosphere for hours together without injury to health if, like sailors, they have plenty of fresh air during the rest of the day.

What is wanted in a house is a constant supply of pure fresh air, to renew the air spoilt by combustion from the breathing of the inmates and by heating and lighting, and to give this without draughts, and with an equable and comfortable temperature throughout the building.

This can be accomplished by a heating apparatus which supplies to the house a liberal supply of mildly warmed air. The earliest and the cheapest form is a furnace, or iron cockle, by passing over which the air gets heated. But the iron is apt to get too hot, and to *burn the air*, as it is called—that is, the particles of dust which almost constantly float in it, as we may see when they are illuminated in a sunbeam. This causes an unpleasant smell, and, as these dust particles are sometimes animal matter, which are resolved into gases by the heat, it is even in-

jurious to health. The evil is remedied in the *Gill stove* by giving a large *surface* of metal for the air to pass over, disposed in flat plates like the gills of a fish; or even by such a *mass* of metal in the stove that the fire cannot overheat it.

These Gill stoves have the advantage that they require no special heating chamber to be constructed for them, and that they can be attached to an ordinary flue—even one with a bad draught. They are largely used in churches and in the halls of houses.

HEATING BY LARGE HOT-WATER PIPES.—To avoid the danger of overheating, in the most expensive kind of heating apparatus, the air is heated by being passed over pipes about four inches in diameter, through which there is a circulation of hot water from a boiler. The greater mass of these pipes is usually formed into a coil in a heating chamber through which fresh air from the outside is passed, and led by channels into the house, to the vestibule and hall and wherever wanted, whence it diffuses itself through the house. Other portions of the pipes may be led to a distance and formed into another coil, providing another source of heated air; or may heat parts of the house, such as passages, by simple radiation.

But even this system of introducing fresh air, heated over large pipes of hot-water, though superior to that of heating the air in a room by a close stove, or to hot air heated by an iron cockle, has its disadvantages. It requires some skill and attention in management, which cannot always be expected in domestic servants. Its fire must of course be looked after like any other; but, unlike those in our rooms which we see constantly and can attend to, it is usually out of the way in some underground cellar, where, not being seen, it goes out; or, to save the trouble of perpetually attending to it, the fuel is heaped on and the

damper opened, so that the water in the pipes becomes too hot, and overheats the air, especially if the weather is not cold, and the air does not require much heating.

With intelligent management this need not happen. With slow-burning fuel supplied twice a day, and proper arrangement of the draught, an equal moderate temperature may be kept up, but the supply of air from the outside should also be regulated. In cold weather less should be admitted, not only because the fire might not have sufficient power to heat a large quantity of air below the freezing point to a proper temperature, but because, from the difference of temperature outside and inside, there is a greater rush of air into the house; and, from the greater velocity at which it enters, a smaller opening is sufficient to supply the necessary quantity.

The heating apparatus should be under the care of some one servant, and conveniently situated, so that long journeys have not to be made to look after it. It is sometimes placed near the laundry, and under the care of the laundry-maid. When a conservatory is attached to the house, the same apparatus may serve for both, placed under the care of the gardener, who, since it is a main part of his business to attend to heating, is likely to understand its management; and can, in the ordinary course of his duty, in attending to the temperature of the conservatory, keep it up even during the night or early morning. This obviates the necessity of burning fires in the rooms, to air the house when the family and servants are absent and the house shut up. In this case it would of course be so constructed that the heating could be shut off, if desired, from either house or conservatory.

The openings for the admission of hot air should be made so that they can be closed by those in the room when it gets too hot, as well as the openings for admitting cold air to the apparatus from the outside. These also should

be under control from inside, so that as the outside temperature gets colder, and the air comes in at a greater velocity, the temperature may be kept up by diminishing the size of the aperture for its entrance.

From our preference for open fires, and from the difficulty of securing that each room shall get its own share of heated air, where there are openings into a number of rooms at different levels and various distances from the apparatus, it is generally advisable, in an English house, to confine the supply of heated air to the halls and staircases, where it tempers the cold draughts as they enter.

Sir William Thomson has used the heat of the kitchen fire in an ingenious manner for ventilating and warming his house at Glasgow. He has taken the pipes of the hot-water circulation, heated by the kitchen boiler to the staircase window, turning them backwards and forwards two or three times, immediately above the sill in lengths equal to the width of the window. To each length a copper flange is attached forming a louvre like a venetian blind, which the hot water keeps warm. By opening the lower sash a few inches the fresh air enters, getting warmed as it passes over the louvres.

In other ways a heating apparatus of hot-water pipes on a small scale is sometimes worked by the kitchen boiler. To be efficient this will require a larger fire in the kitchen than would otherwise be wanted, which in summer, when the heating was not wanted, would be waste. But the kitchen fire could be arranged with a separate boiler for the heating apparatus, from which the heat could be shut off, distinct from the boiler which gives the hot-water supply of the house, which is wanted in summer as well as in winter. This arrangement has the advantage that the kitchen fire is sure to be looked after and so the heating of the house kept up.

The decision of the question whether a house should have

a special heating apparatus will depend on a variety of circumstances. Some people object to them altogether, as tending to make the family less hardy and less capable of enduring cold. But some people can't stand cold; and in a large house with great halls and long cold passages, a powerful heating apparatus may be necessary. Constant supervision is required; there is the probability of making the house too warm, and the chance of the apparatus getting out of order; and there is a certain amount of risk. Each year some historical English mansion with its accumulated wealth of art is burnt down from the overheating of a hot-air flue.

In most houses a supply of mildly warmed air may be got more simply and cheaply, and more in accordance with our ordinary habits, by WARM-AIR GRATES. In these the fire is open, and they are placed in ordinary fireplaces in the hall or rooms, where they can be seen and attended to. They are made with back and sides of fire-brick with an open space behind, up which fresh air, introduced from outside, passes, gets heated in its passage, and comes out by a grating in the front of the grate over the fire, which should be kept closed till the grate is heated. Theoretically they are not economical of fuel, but in practice they probably burn less than a stove with the draught of a furnace, in which any amount of coal can be burnt by mismanagement. But it is unnecessary to have these air grates in every room, most of the grates will be of the ordinary kind, heating the room not by supplying warm air, but by radiation.

In ordinary houses such ventilating grates warm the air sufficiently to prevent our feeling it as a cold draught, yet not too much to make it unpleasant to breathe. A house heated by open fires must be supplied with air, else the chimneys cannot draw. The usual source is the bad fitting of the windows. This is better than nothing, but

the supply is limited and strikes us in a cold draught. It is clearly better to warm the air a little and let in plenty of it. When placed in an entrance-hall, such air grates give a pleasant, genial warmth throughout a house, and in moderately cold weather enable fires in bedrooms to be dispensed with. I have not found them always successful in sitting-rooms. They do not, and they ought not to warm the air sufficiently to let it blow constantly on us as we sit at the fire. Their communication with the open air makes them difficult to heat in cold weather. And there should be means of closing this opening, as well as that into the room. In entrance-halls I have found them to answer well.

Sometimes gas stoves are used to give a supply of heated air. They can be so constructed that the products of combustion of the gas are still carried off and only pure air comes into the house. They are often useful in small conservatories, but are not an economical mode of producing heat.

RADIATORS.—After the open fire, one of the best means of radiating heat in a room is the large German earthenware stove. Its large surface and its material prevent its getting so hot as an iron close stove, and consequently it does not over-heat the air, or render it unpleasant, as close iron stoves are apt to do. Iron stoves are frequently made unnecessarily disagreeable by being polished bright with substances which smell when they are heated. But it is probable that the sense of oppression and closeness, and the disagreeable smell which close iron stoves frequently produce, arise often from their not being air-tight, and thus allowing the products of combustion to leak out into the house. But for this the common little gas stoves of fire-clay, shaped like a bee-hive, would be a most satisfactory and convenient mode of heating for many purposes. It ought to be within the power of practical science to construct these so that the

products of combustion of the gas should be carried off and not come into the house.

In a house he has lately built in the country, Sir W. Thomson has adopted a simple and economical method of heating by means of radiation. An iron flue is carried from the basement through the centre of the hall staircase and the story above, and through the roof. A fire is lit in an iron basket at the bottom, which is hoisted up in the flue to the level of the floor of the hall, at which point the iron flue expands into flanges or buttresses round it. These give a large surface of iron, which prevents any part getting too hot. The waste heat of the smoke going up the flue warms the upper stories of the house. The flue being exposed in the hall is made ornamental.

In many cases we require a means of radiating heat which can be carried to any position where it is wanted in a building, under windows, or wherever we wish to counteract the cold. Large hot-water pipes are inconvenient in many respects for this. They are bulky and require special places to be made for them, and as a large quantity of water has to be heated it takes some time to get up the heat with them.

Small high-pressure pipes have the advantage of getting up the heat quickly, and of being led anywhere without difficulty; but they are apt to burn the air. They are made of extremely thick metal to prevent them bursting, and in some cases rattle in an alarming manner.

Low-pressure steam pipes have been a good deal used in America, and are coming into more common use in this country. They are so arranged that the pressure cannot exceed a limited amount. Steam has the advantage of being lively, of travelling fast and finding its way to any point however distant, through any tortuosities.

Such hot pipes, especially when they are heated by steam, can be led anywhere, and arranged in bundles, as

radiators, at any point required. Such a radiator might be placed in a passage, in an upper floor, or in any part of the house too far distant from the hall to get the benefit of its heating apparatus. Even in a room heated by an open fire it may be of advantage to have such a radiator in the cooler parts of it, as under the windows; thus counteracting the draught which a window causes, even if it be air-tight, from the heated air of the room becoming cooled against the glass, and falling in a stream of cold air.

They may be used with advantage in large public buildings. In large schools they are sometimes used in the schoolrooms instead of open fires, where they have the advantage that several of them may be placed in the room, and the heat thus more equally distributed.

But they have this disadvantage, as compared with open fires, that they do not, like them, ventilate the room as well as heat it. Besides radiating heat, they heat the air in the room without renewing it, and thus produce a stifling atmosphere. This may be partly obviated by putting a pan of water over them, which, evaporating, supplies the air with the additional moisture it requires as it gets heated. But where they are the only means of heating, and in schoolrooms especially, we must find some means of giving the room a constant supply of fresh air. This may be done by Tobin ventilators, as described in the next chapter, or the fresh air may be let in so as to be somewhat warmed by the radiator before passing into the room. This is best done by introducing the fresh air over the top of the stove or bundle of hot pipes; as, being cold, it falls down over these and gets heated before passing away. If it is introduced at the bottom it is apt to be blown at once across the floor without getting heated.

But some means must also be provided for extracting the foul air from the room, as an open fire does by the chimney. Openings at the ceiling are an uncertain means of doing

so, as the cold air is quite as likely to pour down these into the heated room as the foul air to go out, unless such outlets are constructed as flues, and some means taken of securing an upward draught in them. It might be managed by placing a radiator in the ordinary fireplace opening of the room, so as to have the effect of an open fire of causing an upward current in the chimney. But this question more properly belongs to the next chapter on Ventilation.

There is no objection to a high temperature in such radiators, whether close stoves or bundles of hot pipes, any more than in an open fire, if they merely radiate heat and do not heat the air and make it too hot to breathe. This may be avoided by proper ventilation, carrying off the air which comes in contact with the radiators before it gets too hot. Some precaution must be taken, if the radiators are heated to a high temperature, that we do not get burnt by coming in contact with them; but it is not advisable to conceal them by ornamental iron gratings, which act as a fire-screen, and prevent them radiating the heat. They need not be offensive in appearance, and it is sufficient to have some slight bar or fender round them to prevent us coming in contact with them.

Though I have for convenience sake treated the subjects of Heating and Ventilation separately, they must in practice always be considered together, and possibly some of the statements of this chapter may be made more intelligible by the chapter on Ventilation which follows.

SMOKE FLUES.—The comfort of a house depends more on the chimneys drawing perfectly than on any other single circumstance. The annoyance of a smoky chimney is constant; the flue may go well for a time, but suddenly, when unexpected, with some change of wind, the draught reverses and pours down the chimney, blowing the fire

into the hearth and carrying with it a mass of soot which falls in a shower of smuts over the room. Others are rather fretful than outrageous, sending back a puff now and then, just enough to keep up the smell of smoke in the room. Others only require to be "started," and then go steadily and well. Others when without a fire have a steady back draught in them, keeping the room filled with a faint odour of soot and sulphur. The grate is usually blamed, and unquestionably sometimes a flue which smokes with one kind of grate is cured by changing it for a different one; but the evil of smoky chimneys arises in most cases not from any fault in the grate or fireplace, but from the faulty construction of the flues. This is almost an unpardonable offence in an architect or builder, for it is one which it wanted only care and knowledge to avoid, but which it is always costly and sometimes impossible to amend. Another frequent cause of chimneys smoking is that we do not give them air. This rises from over good building, and is easily corrected.

The cause of the upward draught in a flue is that the air in it is hotter, and therefore more rarefied and lighter than the surrounding atmosphere, and consequently ascends. Some chimneys "draw" without a fire in the grate; others have to be "started," when the fire is first lit, by burning a mass of paper a little way up the flue, to raise the temperature in it and turn the draught. A new factory chimney, even before any fire has been lighted in it, has a strong draught upwards, because its mass of brickwork retains the sun's heat, and rarefies the column of air inside it.

The main recipe, therefore, for making flues draw is to protect them from the cold external atmosphere. This is best done by building them in internal walls, which has also the advantage that it contributes to the general warmth of the house, instead of the heat being wasted in uselessly warming the external air. This increases the cost of

building, for it necessitates the building of these internal walls to contain the flues, in addition to the external walls in which the flues are usually placed, and it also lessens the space in the house by the amount of ground which these internal walls occupy. But now that coals have become so dear it is an economy in the end, even in small and cheap houses. If the exigencies of the plan compel flues to be placed in outside walls, they should have a good mass of materials outside them, which will prevent the external atmosphere affecting them and will also retain the heat and keep them warm.

The wall outside a flue must be impervious to damp, else, with continual rain beating on it, it may become soaked, and making the chimney cold, cause a down draught, and blow all the soot into the middle of the room.

Chimney flues must also be perfectly tight along their whole course, else the cold air coming in from the outside by the smallest chink may make the flue cold, and turn the draught downward into the room. For this reason it is an additional precaution, instead of the usual lining of plaster, to form the inside of the flue of pipes of fire-clay, round which the brick or stone work must be solidly built, as this lessens the number of joints and the risk of openings. These pipes should not be glazed on the inside, else the soot does not stick to them, and comes tumbling into the fire or even into the room, but have a rough surface, so that the soot sticks till the chimney is swept.

These flue pipes are usually made circular in section, as being more easily swept, avoiding the corners in which the soot sticks in square flues, and allowing a greater mass of brickwork to be packed round them; thus helping to keep the flue warm. The ordinary square flues built in brick and plastered inside, like those of every London house, are as good as is wanted in inside walls, or in the party-walls of houses built in rows, where the fires of one house keep the

next house warm. In a square flue there is sometimes a double draught, the column of smoke and hot air ascending in the centre, and cold air from the outside descending in the corners to supply the fire. With a round flue the fire in such cases might smoke, as it would draw down the supply for its combustion through the ascending column and destroy its upward draught.

In constructing flues, there must be no obstacle which would check the upward draught, such as sharp bends or contractions or level parts in their course. It is not necessary that flues should be straight; on the contrary, they are sometimes bent purposely near the top, for the purpose of checking and turning a blow-down from their openings, and with the same view they are sometimes made with level ledges in their course. Sometimes a down draught is corrected by an opening in the side of the flue, near the top, so constructed as to give the air which blows in at it an upward tendency. Chimney cans are frequently made on the same principle.

Height in a chimney aids the upward draught, as the longer ascending column has greater force than a short one; for which reason the chimneys of attic rooms are more liable to smoke than those of the lower stories. It is well always to carry the chimneys high above the roof, not only on this account, but because it removes their openings at the top out of the influence of the air-currents caused by the wind striking the roofs, which frequently injure the draught—not in thin iron or zinc pipes, but in solid brick or stone work, which can retain the heat and resist the outside cold. This is better, also, in appearance; for the thin starved look of the chimneys is one cause of the meanness of modern house architecture. We have got over the folly of the Classic architects, who, because there were no chimneys in Greek temples, tried to conceal them in houses which must

have fires for nine months in the year. Having accepted them as necessary, let us not be ashamed of them, but, as they must be the crowning features of the building, make the most of them, and raise them like towers against the sky, as in the old French châteaux.

Before there can be a draught up a chimney, there must be a sufficient supply of air to the fire at the bottom. The want of this is a frequent cause of smoky chimneys in modern well-built houses.

In old houses the fires got their supply chiefly from the chinks of badly-fitting windows and doors; but by perfect workmanship in these, by swing doors and other contrivances to keep out the cold air, we manage to make our houses nearly air-tight. At the same time we have more fires. The very much greater number of fireplaces, compared with the cubical space, is one of the most characteristic differences between old and modern plans. These fires are consequently driven to get their supply of air down each other's chimneys; or from some weaker fire, which in consequence smokes, especially if there are two in the same room; or through ventilation openings intended for the exit of foul air; or down some cold chimney, bringing a smell of soot into the house or even "back-smoke" out of the next chimney top, which, before it can be dispersed into the air, is thus drawn down into the house again.

Though our flues might draw better and our houses be healthier if they were not so air-tight, the proper remedy is not to fit the windows badly, but to provide a sufficient supply of air. If the air is warmed before it is brought into the rooms, we can have without discomfort a larger supply.

In French houses a supply of air is brought from the outside by a pipe under the floor, and after passing over the back of the grate, where it gets heated, is brought

into the room by perforations in the front. The air grates, already described, are the same in principle, but provide a larger supply of fresh air.

For large houses it has been usual in this country to introduce a plentiful supply of air, moderately warmed by a heating apparatus, into the hall, or corridors and staircases, whence it may find its way into the rooms, and thus supply the open fires.

A smoky chimney may sometimes be cured by leading a supply of air to the fire by the back or side of the grate, with the disadvantage, however, that if all the draught of the chimney is supplied in this way, it will have no influence in ventilating the room.

As a frequent cause of smoky chimneys is that there are too many of them in the house, all larger than necessary, so that they require more air than the house can supply, they may sometimes be cured by lessening their diameter beside the fire, and also at the top by means of chimney cans, to prevent the cold air blowing down.

Sometimes open fireplaces, designed with a dog-grate standing on the hearth, and the firelight glancing from glazed Dutch tiles lining the sides, are found to smoke, and can only be cured by the substitution of a common close grate. Before risking a fireplace of this kind, the builder should be sure that the chimney has a good draught.

If well protected and rightly constructed, chimneys will draw without any scientific arrangements of patent chimney cans. In chimneys badly situated, and exposed to gusts of wind from higher buildings near them, these may be sometimes effective; but a down draught caused by a cold flue will force its way through the most complicated contrivances for preventing it—through cowls and dismally-creaking rotatory cans, monsters with outstretched arms, and all the hideous inventions of the smoke doctors.

In a cold flue, when the fire is lit, the flame and smoke,

instead of ascending, blow out into the room. Opening the window does no good, for the room acts as a chimney, and the chimney as an air supply. A fire like a furnace may turn the current; but as soon as it gets low, and the chimney cools, the balance changes again and the current turns downwards, filling the room with smell and soot. To remedy a smoky flue of this kind is difficult, and may necessitate reconstruction; as the evil frequently arises from the wall being too thin or porous, or not air-tight. A coat of cement or rough-cast outside, or some treatment of the bricks, to prevent them absorbing moisture, such as oiling them, may cure the evil, though perhaps at the cost of spoiling the appearance of the house. If rightly designed at first a house need have no smoky chimneys.

CHAPTER XI.

VENTILATION.

THE evil of foul air is not so obvious as that of smoke, and people do not concern themselves so much about it. They would be willing to have ventilation if it were self-acting—contrived so that it should, without needing to be attended to, diminish the supply of fresh air in cold weather, and increase it in warm. But this is about as reasonable as to ask for a machine which would put more coals on the fire, or an additional blanket on the bed, when the weather grows colder.

Nor is the common horror of fresh air in houses altogether groundless. When people are well clothed and well fed, the more fresh air, however cold, the better; but it consumes the animal heat, which is the life, and half starved and thinly clad people have none to spare, and keep themselves warm by huddling together and closing every chink in their rooms. Nor are the evils of bad air so obvious or immediate as a cold caught in a draught, which may lay one up for weeks.

Bad air is not visible nor always offensive like smoke, and so people are content to endure it, and any arrangements for ventilation in houses must involve no trouble, and be extremely simple in action, else they will not be used. In summer, the best plan, on the whole, is opening the windows; but as we close every cranny in winter, and have gas burning for hours, the atmosphere in the room becomes foul; and although those breathing it, from having got gradually accustomed to it, may not be sensible of its impurity, it does not do them the less harm. It lowers their vitality, and renders them liable to cold.

Contrivances for ventilation in houses seldom act as they are intended. They are usually founded on the principle that air which has been vitiated by breathing, being hotter from the heat of our bodies than pure air, ascends, and openings are therefore made at the ceiling to let it out; but, from the carbonic acid gas in its composition, air which has been breathed is really heavier than pure air at the same temperature, so that as soon as it cools it comes down again. It has less ascending force than the column of smoke in a chimney raised to a high temperature by the fire, and yet openings are made for it to go out which no one would be foolish enough to expect to act as smoke-flues. Flues for its exit are carried along level, between ceilings and floors; openings are made into the chimney, which let in the smoke to blacken the ceiling, and holes cut directly through the wall, which, instead of letting the foul air out, let the cold air in. Even ventilating flues carried to the top of the house are as likely, having no fire at the bottom, to have a down as an up draught. If the direction of the current at such openings is tried by holding a lighted taper to them or by the smoke from a piece of half-lit brown paper, it will generally be found that instead of carrying off the foul air from the room, they are pouring in a stream of cold air to supply the fire. And so, after a time, such ventilation

openings are closed up, as being useless or an annoyance from the intolerable draught they cause, leaving the house to get its supply of air where it can—through open doors or window chinks, or by the simple old mode of opening the windows.

Ventilation consists in the foul air going out of an apartment, and fresh air coming in to supply its place. A single opening, if large enough, will do this, serving as inlet below and outlet above. In good ventilation there must be security that the changing of the air will be carried on in all circumstances. The fresh air must come in without cold draughts, and there must be a power of regulating the quantity of air supplied, according to the number of people who have to breathe it. The quantity sufficient for a crowded party might make the room, with one or two people in it, needlessly cold. As the air in our rooms is usually warmer, and therefore more rarefied, than the outside air, a current of the colder air sets in to them through every opening; the current being increased when there is an open fire. But when the heat outside and inside is equal, as in close muggy weather, there is no movement of the air, and therefore no ventilation. The air let in should be pure, and free from dirt and dust.

Without motive power of some kind there is no security that any contrivances for ventilation will act constantly. This power is applied in two ways—either by forcing in fresh air, usually by means of fans, through openings made on purpose, and thus pushing out the foul; or by extraction of the foul air, leaving the fresh air to find its way in as it can, or by openings specially provided. The first requires a steam-engine, which it is out of the question to expect in ordinary houses. In a house in the heart of London, attached to a manufactory for cleaning feathers, the proprietor, whose life depended on living in a mild pure atmosphere, made use of the engine of his works for

producing such an atmosphere in his own house. The air, properly warmed, was forced in through a series of wire gauze screens, for the purpose of purifying it. The first screen was thick with dirt from the ordinary London atmosphere; only after passing through the fourth did the air become reasonably pure. This system of ventilation fulfilled all the necessary conditions and the air in the house was fresh and pleasant, even when crowded with guests; but few of us have steam-engines, nor, if we had, would we take the trouble of looking after an arrangement so complicated.

The system of forcing in fresh air into a building by means of fans has been a favourite one with engineers when they had unlimited funds at their command. Dr. Reid, of ventilating celebrity in his day, used it in ventilating the Houses of Parliament. The floor of the House of Commons is a vast iron grating. Through a chamber, extending all under it, fresh air was forced by fans into the House. The Members complained that the wind, produced by the fans, blew up the dust from the floor, which they had to breathe, and if the fans worked too strongly the air not having sufficient exit became compressed, as in a diving-bell, producing headache and unpleasant sensations in the ears. The use of the fans has long been dispensed with. Instead of the fresh air being forced in, the vitiated air is now pulled out by a shaft which supplies the air for the combustion of a great furnace. This system has been found to work well. The requirements of ventilation in this case are difficult. The sittings continue for many hours; sometimes the House is crowded, at other times there are only a few Members in it. The proper amount of heat and air is controlled by means of a staff of attendants. The mode of extracting the foul air by supplying combustion to a furnace is, however, not economical. As good a draught can be got with less fuel by raising the temperature in an extracting shaft.

In the Capitol at Washington the fresh air was forced into the building by fans. The result is thus described by Mr. Leeds:[1] "The fresh (!) air is taken in through the basement into the cellar, and there forced up by fans through an immense stack of dirty, rusty iron pipes, coated by many years' accumulation of rust, particles of decaying animal and vegetable matter, roasted up afresh every day; from thence it is driven through a labyrinth of uncleaned horizontal air-ducts, filled with the moulding and decaying dirt that has collected for years, and finally driven through uncleaned spittoons (originally intended for air gratings), arranged all over the floor of the House, issuing into the Chamber at a temperature of from 100° to 120°—a warm, debilitating, filthy, disgusting mass for the Members to breathe."

The system of ventilation by forcing in air by means of fans may be theoretically good, and even economical, as engineers assert; but in many cases it has certainly not worked well. It is more complicated than the natural method of raising currents by creating differences of temperature. The fans are costly, and costly to work; they require a steam-engine and the constant attendance of a skilled engineer. But even if they were suitable for public buildings they are out of the question for dwelling-houses.

Without complicated machinery, and at small expense, the foul air can be extracted from rooms by the action of heat. Our common way of doing this is by the fire and chimney. The air, vitiated and heated by gas and breathing, ascends to the ceiling then comes down again and goes out by the chimney. It seems more reasonable to make an opening for it at the ceiling and carry it off at once. This is easily done by making a hole into the chimney at the ceiling, taking out one or two bricks, and inserting an Arnott ventilator—an iron box provided with a balanced flap,

[1] A treatise on Ventilation by Lewis W. Leeds. Second edition. New York, 1876.

which, when the draught of the chimney is upwards, lies open allowing the chimney to suck away the bad air, but which is shut by any back draught, thus preventing the smoke from coming into the room. These ventilators are cheap, and when the chimney has a good draught, efficient, and therefore generally work better in the rooms on a sunk story than in attics. The opening may be into another flue than that of the room ventilated.

The same principle of using a smoke flue to ventilate a room may be applied in another way. Make an opening in the ceiling and lead from it a zinc pipe between the joists, up the back of the fire of the room above, and into its chimney. When this fire is lit its heat will produce a good draught in the zinc pipe, drawing off the air from the ceiling of the room below.

A special ventilating flue is sometimes carried up among the smoke flues. I have found this to act well, the heat of the neighbouring flues rarefying the air in it, and giving it an up draught. A jet of gas burning in it at the bottom (which may be lit when there is extra lighting and many people in the room) will secure a strong up draught. But there should be means of easily closing such a flue, for at times there may be a down draught in it, sending a stream of cold air on the heads of those sitting under it.

There is another mode of drawing off the vitiated air from the ceiling, which can be applied to ordinary brick flues. The diameter of these is usually fourteen inches by nine. Divide this along its whole course, from the ceiling of the room to the outlet, by a thin iron plate, leaving about nine inches square for the smoke flue, and let the remainder ($9 \times 4\frac{1}{2}$) open into the room at the ceiling, as an air flue. The air in it being rarefied along its whole course by the heat of the smoke flue through the iron plate, makes it a most efficient extracting flue. Its action will be uncertain

if the fire is not lit, but a gas jet may be provided in it at the bottom, which would make it act in summer. In this case also we may use another chimney than its own for ventilating a room.

The kitchen fire is kept burning in summer as well as in winter, and especially when the public rooms are filled with company, and its waste heat is therefore a motive power which can constantly be depended on for ventilating rooms. The kitchen fire is utilised for ventilation by making its flue an iron pipe, carried up in the centre of an air flue, in which, by its heat, it causes an up current. This plan has been long in use for ventilating the kitchen. In a house I built ten years ago, I divided the air flue surrounding such an iron smoke flue into three separate air flues, by iron plates attached to the iron smoke flue. One of these air flues draws the air from the ceiling of the kitchen, another from the dining-room, and another from the drawing-room. The result was satisfactory in all the rooms, and I have since carried out the plan whenever I have had an opportunity. Even when the kitchen flue is not beside these rooms I have found the draught strong enough to draw the vitiated air from them for some distance, through a flue, running nearly level under a floor, before it ascends beside the kitchen flue. A single air flue might ventilate the three rooms by openings into each at their ceilings; but there might in this case be a risk of kitchen smells coming into the dining-room or drawing-room. To prevent rain or snow getting down the ventilating flues, they should be covered either with a flat stone, supported at the corners like a stool, or by a box of zinc with louvres at the sides to let out the air, the smoke flue being carried through this covering; this also prevents smoke and soot getting down the air flues.

I have found all these modes of using heat as a motive power for extracting foul air efficient; which of them

ought to be adopted will depend on the circumstances of each case.

Secondly, air cannot be extracted from a room either by the fire and smoke flue, or by ventilating flues, unless air from the outside comes in to supply its place, and this fresh air should come in without cold draughts.

In ordinary houses no provision is made for the admission of air to supply the fires. It finds its way in by the chinks of badly-fitting doors and windows, or by openings made for letting out foul air, and if these openings are insufficient to prevent the chimney smoking, by opening the window.

Some better way of securing the inlet of a large quantity of fresh air, without cold draughts, has for long been an imperfectly solved problem of good ventilation. A tolerably efficient mode of solving it is by warming the fresh air before its admission, in some of the ways already described; for heating and ventilation should be considered together, as two parts of the same problem. But this does not provide for summer ventilation, and air, blowing continuously on a person's head, even when it is heated to a temperature of 55° or 60°, may produce the effects of a cold draught. Generally this system of heating the air is efficient. It enables us, without danger of cold draughts, to introduce a sufficient quantity, and checks the in rush of cold air at the chinks of windows, and it warms as well as ventilates the house.

But we cannot have it at all times, or in every room, so that it is of advantage to be able to introduce *cold* air without draughts. The difficulty is, that being heavier than the warm air of the room, if we introduce it at the top it makes a down draught; if below, it lies as a cold stratum on the floor (whence the reasonableness of the old fashion of sitting on high chairs with footstools), and

goes up the chimney without improving the atmosphere of the upper part of the room. If enclosed together the fresh air would, in accordance with the law of the transfusion of gases, unite with the foul air. But the process is slow, and strata of air of different density may keep their own levels continuously in a room—cold fresh air at our feet and hot foul air higher up for us to breathe—or the fresh air may flow in a confined stream through the room, leaving its atmosphere unaffected.

The whole atmosphere of the room must be changed, and the ventilation inlets and outlets must be contrived so as to accomplish this. Sometimes the fresh cold air is introduced below, with the view that getting heated in the room it may rise and go out at some exit provided for it at the ceiling. But it is more likely to remain cold and blow along the floor in a cold draught. If fresh air is introduced at a low level it should first be warmed, so that it rises.

Sometimes the inlet is a slit along the cornice, formed so as to give the cold air an upward direction, so that it skates along the ceiling before it falls. In falling it mingles with the hot air, and thus comes down equally over the room warmed, so that there is no draught. The hot vitiated air is so diluted by the fresh air that it is about as good as pure. Nevertheless if the vitiated air from gas and breathing can be carried off at once, at the top, without our breathing it over again, even diluted, I prefer it.

Some advise that the fresh cold air be introduced about the middle of the walls, and, if it receives an upward direction on entering, its force may carry it far enough into the room to mingle with the hot air, so that it does not fall at once in a cold draught. This system has been employed in schools, allowing the air to enter behind the boarding which lines the walls to a height of four or five feet, or by a box at the bottom of the windows.

A perfect solution of all the difficulties in the inlet of

cold air is claimed for the system which the late Mr. Tobin found out and patented. The principle of this system is that a perpendicular direction is given to the cold fresh air as it enters the room by introducing it through a stand-pipe. The air rushes straight up till it reaches the ceiling, along the surface of which it flows, and, mingling with the hot air there, comes down quietly over the whole room without sensible draughts, and finds its way out by the fireplace opening and chimney, thus constantly renewing the atmosphere of the room. Mr. Tobin said that the idea occurred to him from observing a clear stream of water flowing into a muddy pond. The clear water flowed in a straight unbroken stream to the other side, where, striking the bank, it turned and mingled imperceptibly with the muddy water. The system has been adopted in several hospitals, a stand-pipe being placed between each bed; the wards are fresh, and the patients feel no draught. It has also been largely adopted in houses, and in most cases where it has been tried it renews the atmosphere without cold draughts.

Whether or not, as has been claimed, the idea had been previously discovered, Mr. Tobin had the merit of appreciating its importance and of making it generally known. One correspondent in the 'Times' said he had ventilated his rooms for some time on the system before he heard of Mr. Tobin's discovery. Several years ago I had, in one case, stumbled on the idea. In a low kitchen cold air had been brought in at the floor, and the cook complained that the atmosphere was stifling above while her feet were in a cold draught. I recommended that the inlet should be continued in a standing pipe, so as to carry away the heated air along the ceiling and down to the fire.

One great advantage of the system is the ease with which it can be applied to any room, even in an old house. It requires no reconstruction of flues or cornices. All that is

wanted is to set a wooden stand-pipe, about four or five feet high according to the height of the ceiling, on the side or in a corner of the room, connected with the open air by a hole through the wall at the floor line, the size of a brick or two.

Another mode of carrying out the system is to make the ordinary sash window with a deep sill, which, when we raise the sash a few inches, keeps the opening at the bottom closed. The fresh air enters at the long slit between the two sashes, receiving an upward direction between the upper sash and the raised lower sash. A board about four inches broad stuck in under the lower sash, when it is opened, produces the same result.

The system is so far self-adjusting that the greater the heat in the room, the greater the velocity, and consequently the quantity of the fresh air which enters. Mr. Tobin therefore advises that the ventilators be made without any means of closing them. But the actual facts are not always what they ought to be according to theory. In one case I found that in the rooms on one side of a house ventilated on this system, the entrance of air by the pipes was so slight as to be almost imperceptible, while, at the same time, in the rooms on the other side it rushed in with such force, and made the room so cold that, in the absence of other means, the pipes had been closed by putting a book on the top of each. The explanation was that a strong wind blowing against this side of the house was forcing itself in at the ventilators, and possibly causing a vacuum on the sheltered side of the house.

Mr. Tobin makes no special provision for the exit of the vitiated air, as the pressure of the fresh air drives it out up the chimney, or by any other openings.

As the principle of Mr. Tobin's system is that the fresh air derives the motive power which gives it the proper direction from its being colder than the air of the room, it

seems improbable that it can supersede the system of warming a house, and at the same time ventilating it, by the introduction of a plentiful supply of mildly warmed air.

But some recent experiences have shown me that it works better in this respect than I had imagined. I recommended that a large office which I built in the city, with about forty clerks in one room, should be ventilated and partly heated by pouring in mildly warmed air. The proprietors determined that it should be ventilated by Tobin pipes, and heated by a number of close-bottomed fires. The result has been successful. The office is always fresh and sufficiently warm. In cold weather the ventilation pipes are partly closed, as the cold air comes in too rapidly.

This system is in accordance with nature and true scientific principles; the air is cool to breathe, the fires supply the necessary heat by radiation and act as extractors by carrying the contaminated air up their chimneys. It is difficult, in an office filled with clerks, to arrange the fireplace so as not to over-heat some of them and leave others cold. But by care and ingenuity in planning, this can usually be overcome. When the cause of a smoky chimney is an insufficient supply of air one of these stand-pipes will almost certainly cure it. Even if there are a number of fireplaces in the same apartment, none of them need smoke, as they have all a copious supply of air from the outside.

Thirdly. In good ventilation there must be the power of regulating the quantity of air admitted. An opening which is sufficient for ventilation in mild weather is too large in cold weather; for, in consequence of the difference of temperature outside and inside, the cold air comes in with greater velocity, and accordingly in greater quantity: so that we must have the means of closing such openings at will. This is too obvious to need statement, were it not that philanthropic people, who build cottages for

the poor, exult in making ventilation openings in them which the inmates cannot close. I remember an old woman, who had been put into a model cottage, complaining bitterly to me of such openings, which she had had great difficulty in discovering and stopping up with rags. In one of a series of letters on ventilation, which appeared in the 'Times' in the dead season lately, some gentleman recommended that, even in frost, the cold air should be let in plentifully, and that people should sit in their rooms in their great coats and hats.

Such enthusiasts for fresh air forget the old maxim, that what is one man's meat is another man's poison. The cold and exposure, which are pleasant and invigorating to a robust person, may be death to a weakly one. The same people, from varying states of health, are more liable to cold at some times than at others. Hence the difficulty of getting rid of a summer cold. Open windows, to keep the rooms cool, make draughts everywhere, which give constant accessions of the cold. Fever patients can stand, and, indeed, require an amount of fresh air, and even of cold draughts, which give severe colds to those in ordinary health. Some sleep all the year round with their windows open, till, as in cases I have known, they have paid dearly for their temerity, a damp night giving them a cold which has sown the seeds of lung disease.

This difference of liability to colds in different people is a source of constant difficulty in ventilating public rooms. It is impossible to satisfy every one, unless we can attain the second requisite of good ventilation, which we have mentioned, of admitting the fresh air without draughts.

The admission of fresh air must be regulated, not only by the state of the weather, but by the number of people to be supplied. A lady complained to me that she could not, when alone in it, make a room warm, which I had ventilated by an extractor, worked by the heat of the kitchen chimney.

This was at once remedied by closing the extractor. When the room is lighted and filled with company the room is not over-ventilated.

If we wish proper ventilation we must be prepared to attend to it, as we do to the heating of our rooms by seeing that the fires are kept on, and therefore the openings for the inlet and exit of air should be under control.

Fourthly. In good ventilation, the fresh air should come in clean and free from dust. It should therefore be taken from the purest source available; from a garden rather than from a dusty road.

In our towns with the atmosphere blackened by unconsumed smoke, no source of supply can be free from dirt. From the precautions which nature has taken in the construction of our breathing orifice, this dirt is arrested before it reaches the lungs; and it may even be true, as has been suggested, that the carbon in the London atmosphere prevents disease. Still we should all be thankful for less of it in the form of smuts.

In ventilating St. George's Hall at Liverpool, Dr. Reid passed the air, as it entered, through a spray of water, to free it from dirt and to moisten it, and to cool it in summer. The same contrivance is used at the Albert Hall. In our dwelling-houses the sources of air supply are too numerous to make this plan available even if the water companies permitted it. Nor would the system, above described, of forcing the air through screens by means of steam power, be generally available. An ingenious friend has hit on a simple means of cleaning the air as it enters the house, which has proved effectual. In ventilation openings which he had made to the street, he made the air pass over pieces of flannel fixed in the openings, so arranged as to give the air a tortuous passage, in order to prevent noise entering. Besides shutting out the noise, the rough surface of the

flannel caught the dirt and damp, and prevented them from entering the room. On examining them, after two days of fog, during which, though the ventilator had been kept open, the fog had not come into the room, the flannel was found saturated with moisture and dirt. Some simple and practical means could be devised of fixing and renewing such screens so that any one could use them; though even the small trouble this would involve might be more than most people would give to ventilation. The contrivance could be easily applied to Tobin's ventilators, and would be a great improvement on them by arresting the noise and dirt.

A simpler mode of clearing the air in passing through a Tobin ventilator is to pass it through a screen of wire gauze fixed in it, which will catch the particles of dirt, which can be removed and brushed when needful. But if this screen is placed at right angles across the tube it will seriously diminish its area. We cannot enlarge the diameter of the tube to make up for this, else it would become too wide in proportion to its length to direct the draught properly upwards. But by fixing the wire gauze screen in a slanting position in the tube we increase its area without having to increase the diameter of the tube.

The fresh air ducts into a building should be capable of being kept clean in every part. For this reason long and twisted air ducts should be avoided, even if we leave doors in them for the purpose of sweeping out the dust; and that is never done, for the dirt is out of the way and unseen. The shorter and the more direct the air ducts are the better. But we must sometimes lead the fresh air to the centre of a building. In this case we should if possible have the duct large for a person to enter and sweep it.

Perfect ventilation should combine all these requirements. It should have some motive power, securing the admission of fresh air and the extraction of foul independently of the

state of the atmosphere, and without cold draughts. It should be easily regulated according to the state of the weather; the health of the inmates or the number of people in the room requiring a greater or less supply of air. The air supplied should be of proper temperature for breathing, and pure and fresh, and free from dirt.

It is difficult to combine these requirements of good ventilation, and probably no system can always be depended on for securing all of them together in ordinary houses. The science of ventilating houses has rapidly advanced of late years, and from the attention now directed to it we may hope for farther improvements in simplicity and efficiency.

There is still room for improvement in the ventilation of halls or rooms which are heated by simple radiators, so as to have, in addition to their cleanliness and the convenience of placing them anywhere, the advantage an open fire gives in changing the atmosphere and drawing off the foul air. For ventilating large halls, which are heated by radiators, a simple plan has been suggested by Mr. Leeds, whose remarks on American ventilation have been quoted above. He proposes to introduce the fresh air from the ceiling by a narrow slit along the cornice, on a principle already described, which has been occasionally adopted in this country for ordinary rooms. The air thus acquires a horizontal direction towards the centre of the hall, getting warmed in its course and falling gradually without draught, the action being similar to that of the Tobin ventilator. It is easy in this plan to cleanse the air. The inlet can be from a chamber in the roof, fairly air-tight, which can with ordinary care be kept perfectly clean. Here also the air may be moistened, and in cold weather slightly warmed. The inlet opening for the air may be made round the cornice at one end of the hall, the extractors at the other end. The fresh air falls gradually all over the hall, and

being heated rises and is extracted from the other end, or part of it may be extracted at the floor.

In this plan the air will be most conveniently warmed by passing it over hot pipes, placed in the fresh air chamber in the roof. But we must not depend on this heated air for the heating of the hall. It should merely have the chill taken off it so that cold draughts are avoided, and that we can without inconvenience allow a large quantity to enter, the heating of the hall being effected by radiators of some kind. Open fires are unsuitable in public halls, they over-warm those near them and leave other parts cold. We require more equal distribution of the heat, and this is most conveniently managed by hot pipes, which can be led anywhere and arranged in bundles as radiators at any point required. The same system, or a modification of it, might probably be applied to smaller rooms, in which it was desired to dispense with open fires.

It would be unprofitable to attempt to describe the numberless contrivances for ventilation, for which inventors continually take out patents. Some depend on the force of the wind, and don't work in close weather when we most want them. Most rely for their motive power on the difference in the heat, and therefore in density, between the internal and external atmosphere. When these are equal, as sometimes happens, the motive power is gone. The modes of ventilation I have described, I know to be efficient, to need little attention, and to be not liable to go wrong.

Apart from special contrivances for ventilation, the freshness and airiness, and therefore the healthiness of a house will depend to a great extent on the way in which it is planned. There should always be power of making a draught through a house from one side to another. This gives us the quantity of air necessary in summer, which ventilation

openings are inadequate to supply, and it effectually renews the atmosphere. Workmen's houses of two or three rooms have sometimes been planned on each side of a central passage, and consequently without a through draught to the open air on two sides. In some towns this is very properly forbidden, though it renders the planning more difficult, and necessitates a greater number of staircases in the block. It has been found that houses at the corners of streets, which are generally without adequate through draught, supply a larger proportion of fever cases than others. A little skill in planning would make them as healthy as others, but builders are generally helpless when they cannot carry out their regulation plans. The staircase should be made, as it might be, the most effectual means of ventilating the house, and not, as it usually is, a channel for kitchen smells.

Wards in hospitals are now always planned with windows on opposite sides. Schoolrooms also should have windows on two sides, so that the whole air in the room may be renewed in a few minutes by means of a cross draught. Even if the windows should be kept closed on account of cold while the class is going on, they can be opened in the intervals, and the room filled with a fresh supply for the consumption of the next class. This is the usual system of ventilation in Italian houses. The rooms are lofty, and contain enough air for a day's consumption. During the heat of the day the windows are kept closed to exclude hot air, but are opened to the cool evening breezes, and the house filled with a fresh supply of air. The same plan is followed in the great Italian churches, which are large enough to have their own atmosphere, occasionally renewed by opening the great western doors.

One disadvantage of living in a well-ventilated house is that almost every other house we enter feels close and stifling.

CHAPTER XII.

ARTIFICIAL LIGHTING.

ARTIFICIAL lighting is effected by gas, either produced, as in lamps or candles, from the oil or wax by the heat of the flame which gives the light, or extracted from coal at gasworks, and conveyed by pipes to the jets. The advantage of lamps or candles is, that they do not contaminate the air in the rooms by the products of their combustion as gas does. They give a steadier and pleasanter light; but they cause labour in cleaning and preparing, and they have to be constantly attended to, as they burn down and go out. For the same quantity of light gas is much cheaper: it burns continuously without any trouble whatever; but in burning it produces noxious vapours, which kill plants, tarnish metal, and destroy colouring, and its flame is often unsteady and hurtful to the eyes. Being fixed to one position in the room, we cannot have the light exactly where it is wanted, as with candles; and as light diminishes as the square of the distance, we require more of it.

Where we have the choice, taste and habit will decide in each case which of the systems shall be adopted for lighting rooms; but for the stairs and passages and offices of a house, gas is unquestionably preferable. Could we get pure gas of high illuminating power, there is no objection to it even in sitting-rooms and bedrooms; but too often it is not properly purified, being mixed with other gases which contaminate the atmosphere without giving light. Gas, even if impure and of a low lighting power, may be used without injuring the atmosphere in rooms where the vitiated air is drawn away from the ceiling; all the more so that, as it heats the atmosphere in the upper part of the room, ventilation is more easily effected.

The danger of escape need not be an objection, as with ordinary care in the fittings, and common sense in the management of it, this may easily be avoided. There is perhaps some prospect that we may get gas better in quality than at present. If so, it will probably be more largely used; but where expense and trouble are no object, or brilliantly lighted rooms are not desired, lamps and candles will be preferred.

The mode of lighting by gas adopted in the House of Commons is admirable. It is burnt outside the chamber, the light coming through a ceiling of glass screens. But while other modes of avoiding the impurities from gas are available, it would not pay to adopt this system in private houses. There is a system of burning the gas in a large closed globe ventilated from the outside. It is right in theory, and in some cases it works well; but it produces great heat, it is troublesome to light, and the large globe sometimes gets broken. If we can ventilate our rooms, such complicated contrivances are not wanted.

Lights should be placed above the eye and behind us, lighting our work or the page we are reading and not shining into the eyes. For writing it should be at the left

side, so as not to cast the shadow of the hand on the paper. The most economical position for a light in a room is to hang it from the ceiling, where it sheds its light all round, and it is also in most cases the most convenient. The light on a dining table should be well above the eyes, either from tall lamps or candlesticks placed on it, or from a chandelier or gasalier hung over it. To some people light or rather heat coming down on their heads from a gasalier is unpleasant, and hence I presume arose a custom which was fashionable for a time, of lighting a dining-table from the wall behind the guests. But the evil in this case arose not so much from the position of the lights, as from the excessive light and heat from them. The remedy was not without inconvenience; one had to turn half round to keep the shadow of one's own head off the plate. Candles placed on the table at the level of the eye are unpleasant in another way; they hurt the eyes, and we can't see the faces of the guests opposite across their glare and flicker; with the light hung over the table, especially if reflected by a shade down on it, the brightness of its glass and silver tells; there is no glare in the eyes, and the rest of the room is left in pleasant obscurity.

In most cases, especially when gas is used, people use five or six times the amount of light that is wanted, needlessly increasing the glare and the heat and the contamination of the atmosphere. To look handsome, gaseliers are made with five or six branches, all of which are lighted when one light would suffice, especially when the room is hotter than usual by being filled with company.

Lighting from the walls gives, usually I think, a more beautiful effect to a room than lighting by gasaliers or lamps or candles hung from the ceiling. I don't know the reason, but the fact is testified to by other experience than my own. There is more play of light and shadow than when the room is all equally lit from the centre.

For a time "sunlights" have been fashionable, but their professed advantages have not, I think, stood the test of experience. They were supposed both to light and ventilate, and sometimes they did so, but, the light being placed as far off as possible and its power diminishing as the square of the distance, an enormous quantity was required. A sunlight gives harsh lighting, casts hard shadows, and makes people's eyes look like caverns. Nor does it always ventilate; in many cases the products of combustion come down into the room. To act rightly sunlights should have no room over them; for they should have their chimneys carried perpendicularly away from them, like any other chimney, and not carried level through the floor. And we may want ventilation in the daytime when we don't want light.

In the lighting of stairs and passages there is room for considerable skill. A judicious selection of the positions will allow the number of lights to be considerably diminished.

CHAPTER XIII.

WATER SUPPLY.

A PLENTIFUL and constant supply of good water is one of the most important necessaries of a house; formerly, with this view, houses were built on low levels beside rivers, but our appliances for leading and forcing and storing water give us a larger selection of sites. There are few spots where a well sunk would be so deep that we could not get the water from it to the cisterns at the top of the house by a force-pump, worked by a horse; and where we cannot get even this, we can collect the rain water from the roofs and keep it stored in tanks. From the roofs of a country house, spread out as it is over the ground with its outbuildings, enough water will be collected, even in dry neighbourhoods, to serve the inmates all the year round, especially if the house is occupied during only a part of the year. By proper arrangements, the water may be kept pure, but the perfect purity of rain water makes it less pleasant for drinking. It wants lime and iron, but these can be added. A simple and I

believe effectual way is to lime-white the inside of the cistern, and to place some iron in it so that it gradually corrodes; such as an iron bar placed upright in it, which, from the varying level of the cistern, is alternately wet and dry.

This source of water supply can be made available by filtration, even in a smoky atmosphere, as I know by the experience of one case where, in one of the smokiest and most rainless districts of the east of England, the supply has never failed and the water has been clear. It might be difficult to get the taste of soot out of it, but in this case there was a separate supply for drinking purposes. In this country we have too much neglected this natural and simple source of water supply.

By a judicious arrangement of the position of the cisterns the water may be caught and stored in the house at a high level, so as to save the necessity of pumping up again; but it will not keep so well as in tanks in the ground, nor can a sufficient supply be depended on in such a position. I have sometimes found this plan feasible, but, if a force-pump is required at all, it is as well to pump up all the water required. The store cistern which the force-pump supplies is sometimes on a tower beside the pump at a distance from the house, and is made, with more or less success, an architectural feature.

When a house stands beside a stream or river, the water-power is sometimes made use of, by means of a water wheel, to force up a supply from the stream for the house. But this source of supply is apt to be uncertain; in a very dry season the stream may run too low to turn the wheel, and it may be necessary to make a pond for storing the water, to ensure a constant supply. The machinery is more apt to go out of gear than the ordinary force-pumps used for wells; and river water, especially in a populous district, is apt to be polluted.

On many sites, especially in hilly districts, water can be brought to the house, and to the highest stories of it by means of gravitation. When this can be done it is much the best plan. When it has once been arranged, it goes of itself and gives a constant supply without any expense of pumping or trouble of looking after. A small reservoir is made on the hillside, at a higher level than the house, high enough to allow for friction, and a two-inch pipe is carried a foot or two below ground to the house, and to the top of it; in case of fire, a hose screwed on to this pipe will give sufficient head to send the water to the top of the house.

CHAPTER XIV.

HOT WATER SERVICE.

ONE of the chief improvements in modern house arrangements is bringing a supply of hot water to every floor of the house on which it may be wanted. A boiler is fixed behind the kitchen fire, the flame passing behind it as well as in front. It is provided with a constant supply of water from the main cistern placed higher than the level to which the hot water has to rise. From the boiler a pipe is led to the top of the house, through which the water rises from becoming lighter as it gets heated, and flows back again to the boiler, with branches along its course to the various taps for baths, lavatories, and house-maids' closets. The pipe conveying the water upwards is called the flow pipe, that downward the return. At the highest part of it there is usually a closed iron cistern, strongly made, to resist the pressure of the steam should the water become too hot and boil. This is merely an expansion of the pipe, providing a greater quantity of hot water than the boiler alone would contain.

Sometimes this hot water store is provided in a closed cistern or cylinder near the boiler, with a separate flow and return pipe to it, besides that carried through the house to supply the taps, which in this case has no cistern in its course. This plan has the advantage that there is an economy of heat, for a less quantity of hot water is moving a long distance through the house, motion being only another form of heat. The water ought never to be so hot as to boil, for the force of the steam shakes the pipes and loosens the joints. In case it should, escape pipes must be provided for it. To boil the water is needless waste of heat, and, where it contains lime, boiling it deposits the lime in the boiler and pipes in the form of a hard white crust. This thickens the boiler and prevents the fire acting on the water in it, and sometimes chokes the pipes, which is more serious. With limy water, therefore, a large boiler in which the water cannot readily rise to the boiling point is best; and in every case there must be provision for cleaning it. This is best done from the back, if it can be made accessible.

The danger of a stoppage in the pipes is that the water in the boiler, not being able to flow, may be turned into steam and burst it. This sometimes occurs from the pipes freezing in some part of their course during the night when the kitchen fire is off. Or the supply-pipe may freeze, or from some other cause the supply may be stopped, in which case the boiler, getting empty, will become red hot; the water when it comes into it again will be turned instantly into steam, and burst it.

It is absolutely necessary to protect all pipes from frost; for ice forming in them, from its expansion, bursts them, flooding the house when the thaw comes and allows the water to flow again. They are too often arranged with reckless disregard of this rule. They are placed in outside walls, and carried through attics where the temperature is

often below freezing. To guard against frost, the hot and cold water pipes are sometimes placed together; but this cools the former and makes the latter tepid, and is no security, as the hot-water pipes may freeze if the kitchen fire is off. Besides being placed where they will be protected from the external atmosphere—the main supply-pipe well underground out of the reach of frost, and those in the house rather against inside than outside walls—they should be covered, wherever exposed, with soft felt, or some other non-conducting substance. This has also the advantage of keeping up the temperature of the hot-water supply. The cisterns also should be placed where they cannot freeze.

It is an advantage when all the places where the water supply is brought are kept each above the other in one part of the house. Any leakage is thus confined to one part, where, not being over principal rooms, it does little harm, and the risk of stoppage in pipes and drains is less than when they are carried level along floors. In town houses with a small surface on each floor, the planning can generally, without inconvenience, be so arranged; but in country houses, which cover more ground, water is wanted at various points all over them, and it may be necessary to trust to good plumber-work to avoid this risk. But even in houses covering a large extent of ground I have sometimes found it possible to arrange the places where water is wanted in one position, each over the other, for the different floors; and where it is necessary to have water supply in several positions throughout the house, these should in each case be over one another.

CHAPTER XV.

HOUSE SEWAGE.

THE most important point for securing the healthiness of a house is a right arrangement of the drainage. In this respect we run risks of fever and death, to which our fathers, with no water led into their houses and no drainage leading from them, were not exposed. The English with their system of water-closets were supposed to be far ahead in sanitary arrangements of their continental neighbours, who imitated these sometimes in curious ways. In a lodging, in a fashionable quarter of Paris, where I once lived, and which was furnished with English comforts, there was a water-closet, in all appearance like an English one, which, we discovered, discharged into a barrel below, inside the house, which was emptied at intervals.

Nor have we always been wise in these matters. For a time our sanitary reformers waged war against open drains. Their idea seems to have been to close them up, and shut in the smells. But the drains revenged themselves. A closed drain or sewer produces a dangerous and deadly gas called

sewer gas, which our system of water-closets and closed drains laid on to our houses, the warmth of the house and the draught of the fires sucking it in,[1] the sanitary reformers then set themselves to devise means of keeping it out. The connection between the inside of the house and the drain was barred by various kinds of "traps," as they are called, the principle of all being, that a body of water in the drain or pipe blocks the passage of the sewer gas into the house. Sometimes the trap was merely a dip in the pipe, deeper than its diameter, which, remaining always filled with water, blocked the passage of the gas—sometimes it was a "cesspool" or square box, built of stone or brick, cemented inside, with a stone slab across it, hung from its roof like a curtain below the water level, under which the drainage flowed, while no air could pass. But the sewer gas conquered again. It impregnated the water set to block its passage, and came out in bubbles on the inside into the house. And it was produced in the soil-pipes, between their openings into the house and the trap next the drain. Sometimes the trap became dry from evaporation, or from the suction caused by the rush of water from another closet into the soil-pipe.

Exactly the opposite method of treating sewer gas has been followed during the last few years. As it is close drains which generate it, the drains are now ventilated by frequent openings.

The soil-pipe leading into the drain, instead of being closed by traps at both ends, is left open at both ends to allow a free current of air through it. The openings, that at the top especially, should be the full size of the soil-pipe,

[1] "Sewer gas," though a convenient is an inaccurate term. There is no special gas produced by the sewers. The foul air from them is of different kinds, sometimes bearing the seeds of fever or diphtheria or other diseases, or spoiling the freshness of the air and lowering the vitality, sometimes innocuous and merely smelling badly.

and not as is the custom, a small pipe about a third of its diameter. The soil-pipe itself should be carried up through the roof, and it is well to secure the extraction of the gas by putting an extracting cowl of some kind on the top of it. Special care must be taken to place the outlet in such a position that there may be no risk of the sewer gas escaping from it getting in at bedroom windows, or being sucked down unused chimney flues into the house.

Extracting cowls are of two kinds, those in which a current is produced by the motion of the cowl, and those in which the cowl and all its parts are stationary. Of moving cowls some are rotatory, turning on a pivot. These are frequently used to cure smoky chimneys; they act by screwing the air out from the top of the flue and thus causing a vacuum at the top, which induces an upward current from below. They usually go well at first, but are apt to go wrong. We all know the dismal creaking which such cowls often make on chimneys, when the oil gets done or the pivot gets bent. Sometimes they stick and cease to move. In the case of a smoke flue this is soon discovered, by the smoke coming back into the room; but in the case of a soil-pipe it might remain unnoticed, and is therefore dangerous.

Another kind of moving cowl is a long tube open at both ends balanced on a pivot over the flue, with a weather-cock or arrow attached to it, which keeps the open mouth of the tube headed to the wind which is thus compelled to blow across the top of the flue or soil-pipe, causing a vacuum and an upward draught in it. In some cowls on this principle the mouth which heads to the wind is widened so as to catch a greater quantity of air. Such cowls are less liable to go wrong and stick than those which rotate; if they do they are worse than useless; and it may happen, for the long tube makes them heavier than simple weather-cocks, and these we know sometimes get stiff and stationary.

Stationary cowls have not the same danger. The principle of these is that, by means of plates or louvres in their sides sloping upwards, the wind striking on them is directed upward and draws with it the smoke or foul air in the shaft. Some are even made so that a down draught blowing on the top of them is directed upwards and creates an up draught in the shaft. Cowls do not always answer for smoke flues, for the soot clogs up the small openings by which the wind should enter. This objection does not apply to their use on the top of soil-pipes.

Some experiments lately made seem to show that an open pipe with the wind blowing across the top is as efficient as an extractor as any cowl. But it has been doubted whether these experiments were made with proper care. We know from experience that smoky chimneys are sometimes cured by placing such cowls or extractors on the top of them, and their action should be similar on soil-pipes.

The main thing, however, is to keep the soil-pipe open at both top and bottom. Even if the current of air through it is downwards instead of upwards the gas will not accumulate in it, and at the worst will find an exit at the bottom opening, so that no foul air can accumulate in them.

If the extracting cowl acts well, the opening at the bottom of the soil-pipe will always be an inlet for air, and consequently there will be no risk of sewer gas coming out at it. But, to avoid all risk, this opening should be in such a position that no gas from it can get into the house by open windows. It should also be out of the way of traffic, which can be effectually done by making the opening through a pipe, six or seven feet high above the head of any one passing.

This inlet for air to pass through the soil-pipe need not be immediately at the bottom of it. The soil-pipe when it gets to the ground is continued underground in the form of a drain, which also must be ventilated; and therefore the

inlet for air should rather be placed at the end of the drain. Just beyond this inlet and before the house drain enters the main sewer it must be trapped, or else the gas from the main sewer would come out at the air inlet or up the soil-pipe. This trap disconnects the system of drainage of the house from the main sewer. It is enough that each house should dispose of its own sewer gas without becoming a ventilator for the street sewers.

One mode of forming this opening for admitting fresh air into the soil-pipe, is by letting the soil after it leaves the house run in an open trough instead of a pipe. This trough is formed in the floor of a small chamber underground which should be ventilated.

Sometimes the soil is even discharged into a basin or rain-water head on the wall immediately outside each closet, or into a basin at the foot of the soil-pipe, in the open air, under a grating, whence it flows through the house drain into the sewer, the drain being trapped before it enters the sewer. This system should always be applied to the refuse water from baths and sinks and fixed basins.

Some people consider that the sewer gas from the street sewer being shut off from the house by this trap at the end of the drain, and all the house drains and soil-pipes being ventilated, there is no necessity for a trap at each water-closet, that the water at the bottom of the basin in each closet is sufficient protection against the sewer gas entering the house. Such traps have unquestionably been a fruitful source of foulness and sewer gas. They are usually what are called D traps, from being like a capital ᗜ in form, attached to the pipe with the straight side uppermost. They are small cesspools made of lead so that they can be soldered to lead pipes. A lead plate hung from the top inside forms the curtain under which the water carrying the soil flows; the water always remains in the bottom of the trap above the level of the bottom of the curtain, and so

blocks back the gas in the soil-pipe, and prevents it entering the house through the water-closet. But a D trap is itself a most efficient manufactory of sewer gas. It is square in section, consequently the filth sticks in the corners and on the plate or curtain across it, where the rush of water does not scour it out, and it soon becomes encrusted with foulness. The same objection applies to the old cesspools. Every trap should be round in section, merely a dip in the pipe just deeper than its diameter, in which enough water will lie to block the passage of the gas. Traps of this kind (usually called S traps), being round in section, the rush of water through them will scour every part of them. They have not therefore the disadvantage of the D traps, and I think it safer to continue the use of an S trap under each water-closet. They prevent the air fouled by the soil-pipe and the branch to the closet coming into the house. Even if the soil-pipe have a current of air constantly passing through it, the foul air will remain in the branch to each closet, and may be drawn into the house; for the water at the bottom of the pan is not always to be relied on for this purpose. In some kinds of closet apparatus this water is retained by a flap shutting close against the opening at the bottom of the pan, and if any sand or dirt gets in it does not shut close and does not retain the water. It is therefore safer on the whole to give each closet an S trap. It may probably however be dispensed with with safety when the soil-pipe is thoroughly ventilated, for the contact of fresh air goes far to deprive any soil which may adhere to the pipes of its noxious qualities.

The house drains should be formed of pipes of glazed stoneware, fitted into each other at the joints with cement so that there is no leakage. These are in every way better than brick drains, which are liable to go out of order from leakage and the mining operations of rats. Great pains should be taken to lay them with a continuous fall

without any dips in which the water could lodge. They are best laid on a bed of concrete.

The cistern which supplies the water-closets should not be the same as that for house use. Even with "constant supply" in towns, separate cisterns are wanted for the water-closets, for the supply is not constant; there are some hours each day when the supply forced by the water-works pumps is intermitted, and the pipes become empty. This causes a vacuum in the pipes, and if the closets are supplied directly from the water mains foul air or even foul matter may be sucked back into the pipes and through them into the water mains, thus poisoning, not only the water supply of the house which is the cause of the mischief, but that of its neighbours also. An outbreak of fever at Croydon was traced to this cause. With a separate cistern for supplying all the water-closets of the house, or, if more convenient, with a cistern for each closet, this cannot happen, for this cuts off the water-closets from all connection with the mains.

Some sanitary reformers insist on having the soil-pipe outside the house with connection to it from each water-closet through the wall, so that, if it leaks, and the sewer gas escapes, it escapes into the open air and not into the house. When one water-closet only discharges into the soil-pipe it had better be taken through the wall at once and descend outside; but when several discharge into it it is inconvenient to make so many openings through the thick outside walls of a house; and it gives no absolute security against sewer gas getting into the house. The branches which must be inside the house are as liable to leakage as the main soil-pipe. They might leak in their passage through the wall, where they are buried out of sight, and saturate it with sewage before the evil was observed. It is better to have pipes exposed to view so that any defect can

be seen and be easily got at. Keeping the soil-pipe inside the house presupposes that we can get pipes and fittings which do not leak. This is not an extravagant supposition. The soil-pipe must be what is called a "drawn" pipe, made in one piece; not as is sometimes the case, a "seamed" pipe, made by soldering together the two edges of a strip of sheet-lead. Such pipes should at once be ordered out of a house, even if they do not leak, for the slightest accident may cause the seam to open.

There should be no risk of sewer gas entering the house if the soil-pipe is carried as high as the ridge, and left open, with or without an extracting cowl, air being let in at the foot of it so that there is a draught of fresh air through it, and its communications with the house blocked by traps. One great risk is thereby avoided, that of bottling up the foul air in the soil-pipe and thereby giving it the most favourable conditions for developing poisonous qualities. When thus shut up the gas sometimes ate holes in the lead pipe and escaped into the house. Leaving the pipe open to the air at both ends deprives the sewer gas of its noxious qualities, prevents its being forced into the house by pressure from the sewers, and even causes a current in the opposite direction through the closets, when they are opened, from the house into the soil-pipe.

WATER-CLOSET APPARATUS.—Several kinds of water-closets are in common use, and new inventions are continually advertised. The objects aimed at in all of them are, first, to supply a rush of water to carry off the soil and flush the soil-pipe; and, secondly, when not in use, to close the opening into the soil-pipe against the entrance of sewer gas into the house. The water retained in the pan does both. The sewer gas might be kept out by a trap, but without the water in the bottom the pan would not be cleansed nor the traps and soil-pipes flushed.

To describe the various inventions would require a long treatise. They differ mainly in the manner of retaining the water in the pan. The common "pan closet" is that in most common use, and it is well for householders to understand its construction. In it the soil-pipe is terminated, under the seat, by a large bell-mouth of cast iron, which has a flat top with a round hole in it, into which the earthenware pan is fitted tight. This earthenware pan is open at the bottom. Under this opening a tinned basin is placed kept full of water, which rises into the earthenware pan and so keeps back the sewer gas. Any gas, to get into the house, must pass through this water under the bottom rim of the earthenware pan.

The tinned pan is capsized by pulling up the handle and tumbles its contents into the bell-mouthed receiver and so into the soil-pipe. In this lies the objection to the closet, for the splashing of the soil into the receiver incrusts it in time with foulness. A pan closet must therefore be purified every year or two by removing the receiver and burning it clean in a furnace. Another objection to them is that the receiver being the termination to the soil-pipe is apt to have an accumulation of foul gas in it, which bursts into the house when the closet is opened, and even when the closet is not in use impregnates the water at the bottom of the pan and comes through in bubbles under the rim of the earthenware pan into the house. These objections may be overcome. A ventilating tube may be taken from the receiver, preventing any accumulation of gas in it, and occasional burning out will keep the receiver clean.

The pan closet has several advantages. It is cheaply and easily constructed and its machinery is not apt to go wrong, and, if it does, any plumber knows how to put it right. It has another great advantage. Every closet must have an overflow, else if, as sometimes happens, the stop-cock from

the cistern gets opened, the house would get flooded. In the pan closet the water flows over the tin basin into the receiver and so into the drains. In other kinds of closets a separate overflow must be provided, which sometimes becomes an entrance for sewer gas. The pan closet, though not perfect, is practical and serviceable.

The "valve closet" consists of an earthenware pan in which the water is retained by a hinged metal disc shutting against the opening at the bottom. Those first constructed were kept water-tight by grinding the meeting surfaces so that they fitted accurately, but particles of dirt or paper getting in often prevented the disc closing tight, and let the water out. They are now made with a ring of vulcanised india-rubber fixed round the opening of the pan against which the disc presses close, which generally acts efficiently, and if it goes wrong is easily put right. This closet must have a separate overflow, which should not be carried into the soil-pipe else it might let in sewer gas, but into the bath overflow or a rain-water pipe. The valve closet does not get foul like the pan closet; most plumbers understand it, and on the whole it is one of the best.

In some closets the water is retained in the pan by a plug which is pulled up by the handle, but the plug does not always fit close. Others are made wholly of earthenware without any movable parts, the pan terminating in a pipe which bends upwards before joining the soil-pipe and so retaining some water in the bottom which acts as a trap. These have the advantage of simplicity and cheapness, but little water is retained in the pan; for, if the upward bend is carried high enough to retain any considerable depth of water, the flowing away of the soil is obstructed.

Another kind consists of a double basin formed in one piece of crockery ware. This system is claimed as an

absolute stopper to sewer gas entering the house, and it gives abundant flushing power.

New kinds of water-closets are being constantly advertised, and it is possible that the present kinds may be superseded by some invention more simple and efficient.

Disposal of Sewage.

A most important question in the arrangements of a country house is the disposal of the sewage. In towns and suburban districts this is arranged for us; in the country we must settle the matter for ourselves.

By the arrangement of Nature the produce which the earth supplies as food to animals is returned to it again and maintains its fertility. In our towns and houses we alter this arrangement, and with those products which should fertilise the land we pollute the rivers and render them unfit for human use. Practically, however, the profit to be got out of sewage is unimportant. No means have been discovered which would make it pay its carriage as manure. The main thing is to get rid of it; that we must do at whatever cost. Its utilisation is a secondary matter, and of importance mainly as getting rid of it.

The common mode of getting rid of sewage matter has been by water carriage, in drains, covered or uncovered. In recent years it has been urged that this system is a mistake, that the matter is made pestiferous by being mixed with water, that it ought to be mixed with dry earth which would render it innocuous, and returned to the fields as manure.

It has, therefore, been proposed that the sewage matter of our towns should be disposed of by a system of earth-closets and scavengering; carts bringing the dry earth to the houses and carrying it off when mixed with the sewage. The objection to this plan is that the army of carts which it

would require makes it impracticable. The scavengering of our towns, comparatively limited as it is, is not so well managed that we should still further trust our comfort and health to it, by increasing it to such an enormous extent as a universal system of earth-closets would require.

And, after all, as Dr. Corfield points out in his book on sewage, the system would not be complete; we must have drains to carry off cabbage water, and the refuse of cooking from our scullery sinks, and foul water from bedrooms, and as these produce sewer gas, we run no new risk in adding the soil from water-closets.

The system of water carriage for sewage already adopted in our towns is, therefore, not only much more convenient than cart carriage would be, but is a more complete and scientific solution of the problem.

Where we fail is in the ultimate disposal of the liquid sewage. We ought not to pollute the rivers with it. The sewage of London from the main drainage is forming a great bank in the Thames. Some towns manage rightly, spreading the sewage on the land, the *water* being quite as valuable for producing crops as the sewage matter.

I believe this is the best system for country houses. They must have drains liable to produce sewer gas from sculleries and house-maids' closets, and these may just as well carry off also the soil from water-closets. The most practical way of utilising the soil from them, is by leading it to a store tank near the kitchen garden, from which it may be pumped by a hose wherever it is wanted. This tank is usually covered over, from the old notion of shutting in the smell, with the old result of producing sewer gas. It may be ventilated, but it is best to place it in some inconspicuous position, and leave it uncovered, fencing it to prevent children or animals falling in. It may smell a little, especially when its contents are disturbed by being conveyed to the garden, but the risk of producing sewer gas

will be avoided. Where there is sufficient fall, the distribution of the sewage may be managed by simple irrigation, without the necessity of pumping; or it might be distributed by water-carts. It would not pay a farmer to cart it to his fields, but in some situations, where a house has poor dry soil round it, it might be worth the cost of carting.

In a large house in the country, recently built, the owner has placed earth-closets inside the house, arranged round a small back court, which a cart can enter for removing the soil. This is used in the garden with good results, and all risk of sewer gas in the house is avoided. In this case, the refuse water from house-maids' closets and sinks is carried by drains, whose connection inside the house is broken by passing through the open air, to a neighbouring stream, which it does not harm, being there plentifully diluted.

The old system of disposing of the sewage in the country, when there was no river to run it into, was into a cesspool, a large hole dug in the ground at some little distance from the house, lined with loose walling, which keeps the sides from falling in, but lets water pass. Into it the drains empty, the water percolating into the earth and the solid matter, or some of it, being retained.

The system is a bad one. Applied to the "villa residences" on the gravelly soil of some London suburbs, it has poisoned the soil and the wells; and even when such a cesspool receives only the sewage of a single house, it may poison in time the well of the house. Outbreaks of fever and cholera have occasionally been traced to this cause.

Even for small houses and cottages in the country, it is well to have a tank for the house slops, though the dry earth system is all that is wanted for the closets.

CHAPTER XVI.

BELLS, SPEAKING-TUBES, AND LIFTS.

BELLS.—In the bells of a house the chief thing to be attended to is that their mechanism be so constructed that it does not go out of order.

In the common mode of fitting them, the wires run along the surface of the walls from the rooms to the bell-board in the servants' department. The wires being exposed to view are placed under the cornice where they are least observed, and consequently have to be carried round a number of corners with a crank at each, between which, being stretched horizontally in some parts, they are apt to bag; in others they are too tight, and being subjected to tugging and unequal strain, are apt to break.

In all well-finished houses the bell-wires are concealed in small tubes sunk in the plaster, and generally carried in a straight line to the top of the house, then horizontally to a shaft over the bell-board, where they descend again. By this arrangement not only is the unsightly appearance of the bell-wires got rid of, but fewer cranks are necessary;

the ascending and descending wires, hanging balanced from each end of the horizontal part in the roof, work like a pair of scales, without strain or bagging or risk of breaking. The cranks should be purposely made to suit the different bend and angles, and of sufficient substance and strength to stand tugging and strain.

Some pains should be taken to make the bells different in tone, so that each is recognisable—from the deepest, which is usually the hall bell, to the highest in tone ringing from the attics; and in addition, each bell should have attached to it a disc at the end of a flexible piece of steel, which continues moving after the bell has ceased ringing, letting the servant see which has been rung.

The electric apparatus for ringing bells is sometimes adopted for houses. Its advantage is that the course of the wires being of no consequence, they can be taken to any corner or any distance; and as they do not require to be tightened, they do not break. The battery for supplying the electricity requires attention and occasional renewal of the chemicals. The system is not as yet cheaper than the other, and it has the disadvantage that with it there is no power of giving expression to a ring, as of quietness or urgency, and as the same bell always rings, the servant cannot, as in ordinary bells, tell by the tone the room from which the ring proceeds, consequently some one must always be stationed beside the indicator. In enormous hotels, from the difficulty of stretching the necessary number of wires, it may be the only practicable one; but in private houses, if the workmanship is good, the ordinary system is better.

Air bells have not these disadvantages. Their arrangement is the same as that of the ordinary wire-bells, except that instead of being set swinging by the pull of a wire they are struck by a hammer forced against them by air pressure, conveyed by small tubes. The end of the tube in

the room expands into an india-rubber ball shaped like a pear; squeezing this forces out the hammer at the other end of the tube, which strikes the bell. The tubes are usually of india-rubber. The system is a simple one, easily carried out; I have known a gentleman put them up himself in an out of the way country house, where no workmen could be got.

SPEAKING-TUBES carried plentifully over a house, connecting all the points between which there is any need of communication, save considerable labour in climbing stairs. Their openings, though usually in halls and passages, should close by a spring or plug, that they may not become a means of overhearing conversations.

They should have a bell beside them, to call attention to the message. An air bell is usually employed for this purpose, as its single stroke distinguishes it from the other bells of the house. It acts by the air in a tube being pushed at one end by means of a flexible bag of india-rubber, sending out a hammer at the other, which strikes a bell and falls into its place again. A whistle attached to the end of the tube serves the same purpose.

LIFTS.—Besides the lift for the dinner from the kitchen to the dinning-room, when they are on different floors, another is sometimes provided from the bottom to the top of the house for raising coals and luggage. As it must be perpendicular, with its openings at each floor in a suitable place, removed from all risk of children falling down the shaft, the planning of every floor must be accommodated to it. These difficulties are got over by putting it in the centre of the servants' stair, where it may either be enclosed in walls or slide in an open cage. Unless there is sufficient work for it to do, its addition is a questionable advantage.

It will more readily be adopted where hydraulic power for working it can be procured.

The greater part of the appliances above described—as those for heating ventilating and lighting, speaking-tubes, water supply, especially that of hot water to the upper stories—are modern inventions, and it is in the arrangements necessary for providing them that the special characteristics of modern planning have been chiefly developed.

The convenience and saving of labour which they effect is enormous. Without them, with the difficulty there now is in obtaining servants and in getting work done, the comfort of most households must have been diminished. But such machinery in a house may be overdone. The more there is of it, the greater the need for intelligent management, and the chance of its going wrong. It should never be complicated, and it is better to want it than have it of bad workmanship.

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THE END.

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